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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-fourth General Meeting, American Gas Light Association.

OFFICE OF THE SECRETARY,
PROVIDENCE, R. I., October 7, 1896.

There will be an adjourned annual meeting of the American Gas Light Association held in St. Louis, Mo., on October 27, 28 and 29, 1896.

The meeting will be called to order by the President, C. J. R. Humphreys, of Lawrence, Mass., at 9:30 o'clock, A.M., on Tuesday, October 27, in the meeting hall at the Planters' Hotel, the headquarters, which occupies half a block on Fourth street, between Pine and Chestnut.

The Planters' is one of the very finest hotels in the West, and is conveniently reached by the principal street car lines, and is amply large enough to take care of all who attend the convention. The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed stamped envelope should be enclosed, as misunderstandings may thereby be averted. The Planters' is conducted on both the American and European plans. On the American plan there will be a few rooms at $3.50, plenty of rooms at $4, with bath, $5; or two adjoining, with bath between, $4.50 each, and up. European plan, $2 and $2.50 and up. Rates are the same for corresponding rooms on all floors above the third. The Southern Hotel is a fine house at Broadway, Fourth and Walnut streets, 2½ blocks from the Planters', and is American plan, $3 to $5 a day. The Lindell is a good house on Washington avenue, between 6th and 7th streets, six blocks from the Planters', and is American plan, $2.50 to $4.50 a day.

The change of date from the third Wednesday of October was made positively necessary by an entirely unforseen occurrence. During the first week of that month St. Louis is filled with visitors to the fall festivities, and this year the second week was chosen for the meetings of two very large associations, the Carriage Makers and the Street Railway people; but as the hotels would be unable to take good care of two such large conventions at the same time, the Street Railway convention was changed to the week of the third Wednesday, and as that convention meant about 3,000 persons in attendance, our members could not have been comfortably housed. The President and Secretary therefore went to St. Louis, and after mature consideration in consultation with the local members, it was finally decided that to hold our meeting on Tuesday, Wednesday and Thursday, October 27, 28 and 29, was the best arrangement that could be made.

In order to have the meeting of the 27th strictly in accordance with the Constitution, the annual meeting will be held at St. Louis on the date provided by the Constitution, namely, the third Wednesday of October. It is not expected to transact any business then, but with the assistance of the members already provided for, adjournment will be had to the date mentioned at the beginning of this circular, namely, Tuesday, October 27, at 9:30 A.M.

The meeting hall will be the Ladies' Ordinary, on the parlor floor of the Planters' Hotel; thus the headquarters and hall will be in the same building.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the Secretary's hands by October 17, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"A Discussion of the Methods Employed in Introducing Gas Stoves," by Charles H. Nettleton, Derby, Conn.

"Some Experiments on Internal Illumination," by Carter H. Page, Jr., Philadelphia, Pa.

"Inclined Retorts up to Date," by Frederick Egner, Norfolk, Va.

"A Modern Retort House," by Wm. A. Miller, Cincinnati, O.

"The Separation of Water Gas Tar," by Alten S. Miller, Long Island City, N. Y.

In addition to the above there will be several topics brought in for discussion by short written introductions. Three of the short topics already provided are:

1. "An Experience with Prepayment Meters."
2. "Wet or Dry Heat—which Gives Best Results in Purification?"
3. "The Use of the Jet Photometer."

All questions for the Question Box should be sent in to the Secretary as soon as possible in order that they may be printed in the next circular before the meeting, thereby insuring their discussion.

During the days of the meeting all announcements will be posted on the bulletin board in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the Local Committee in their work, by affording a ready means of recognition.

In order that the Year Book containing the report of the St. Louis

meeting may be published and issued to the members immediately after the meeting, notice is hereby given that if any of the speakers at that meeting desire to correct their remarks in discussions before they are printed, they will be given an opportunity before leaving St. Louis, but *not* after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meetings, and all those who desire to correct their remarks *must* notify the Secretary at the close of the session at which such remarks are made, as all the report will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one-third fare returning by the same route) by the several Passenger Associations named and under the conditions noted.

The Central Passenger Committee, covering the following grounds: Bounded on the east by Pittsburgh, Salamanca, Buffalo and Toronto; on the north by the line of and including points on the Grand Trunk Railway from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook county, Ills.; on the west by the west line of Cook county and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, including points on either side of that river.

The Southern States Passenger Association, covering the territory south and west of the Virginias and south and east of the Ohio and Mississippi rivers.

The Trunk Line Passenger Committee, covering territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N. Y.; Pittsburgh, Pa.; Bellaire, O.; Wheeling, Parkersburg and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Western Passenger Association, from points in Eastern Committee and Trans-Missouri Committee Territories.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations:

1. The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

2. Each person to obtain the excursion rate must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

3. If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where each purchase is made.

4. Tickets for the return journey will be sold by the ticket agent at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

5. No reduction of fare will be made on the return passage if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

6. Certificates are not transferable, and return tickets secured upon certificates are not transferable. The transfer of any such is liable to prevent the securing of reduced rates for future meetings.

7. The certificate of agent at starting point, duly endorsed by Secretary of Association, must be presented to ticket agent at place of meeting, within three days (Sunday not reckoned except by Southern Passenger Association) after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

8. No refund of fare will be made on account of any person failing to obtain a certificate.

Special.—Those wishing to join the New York party should communicate with C. E. Sanderson, 32 Pine street, N. Y. City. Be sure to obtain your railroad certificate when buying your ticket for St. Louis. Apply for ticket and certificate at least 30 minutes before train time. Each person must sign his own certificate at time of purchasing ticket for St. Louis. Be sure to have the Secretary endorse your certificate at St. Louis as soon as you get there. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Any person, ladies included, attending the meeting, is entitled to the reduced rate from the territories named.

Members will please hand their certificates to the Secretary, or his Clerk, upon arrival at place of meeting. If there are one hundred members present, holding certificates, each certificate will then be properly endorsed and handed back to owner before adjournment.

Extracts from the Constitution.

Sec. 12. Application for active membership or for associate membership, or for transfer from associate to active membership, must be received by the Secretary at least 10 days prior to the meeting at which the application is acted on.

51. No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.

52. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council.

A. B. Slater, Jr., Secretary.

BRIEFLY TOLD.

Before the St. Louis Meeting.—Before the Journal for this week has reached many of our readers the 24th meeting of the American Association will have been completed. In that knowledge not much of interest can attach to anything that may now be written concerning the convention, which promises results that are sure to benefit those who participate in its proceedings. Secretary Slater has, and under exceptionally adverse circumstances, because of the pressure of urgent personal business, seen to it that copies of the papers to be read have been in the hands of the members for an advance period sufficiently long to enable all to discuss the subjects intelligently. In the matter of entertainment arranged by the local committee nothing definite can be here written; but we do know that when the delegates have enjoyed that which is in store for them on the social side, all will agree that the reputation for hospitality which belongs to St. Louis will have been well upheld. Unofficially, we have been informed that Captain W. Henry White has consented to act as toastmaster, which consent carries the certainty that the Committee has arranged for more than empty seats and bare tables. The New York party, who started in special car by way of the "Penna. Railroad," from New York at 2 P.M. of yesterday, lacks a single politician, and so is certain to arrive "on time" in St. Louis to-day.

Obituary Note, Mr. Richard Spencer.—We regret to report the death of Mr. Richard Spencer, President of the Burlington (Ia.) Gas Light Company and of the Monmouth (Ills.) Gas Company as well, who passed away at his home in Burlington on the evening of the 16th inst. Deceased, who had been practically engaged in the gas business since 1859, was very prominent in its records for the decade of 1875 to 1885, and up to the last was a staunch supporter of its stability and a firm believer in its future. He was born in the village of Jersey Shore, Lycoming county, Pa., Oct. 26, 1823, when that district was virtually a wilderness. In 1830 he journeyed with his parents to Ohio, and in 1840 the family removed to a point in Jay county, Ind., not far from where the present capital (Portland) of that county is located. His father had purchased there a timber section, and the Spencers were in fact on the very frontier line of the States. He taught school for a time in the adjoining county of Adams, but returned to Ohio in 1845, teaching for a while in Greene county, at a point not far from Xenia. Next we find him in Lebanon, O., where he engaged in the saddle and harness trade on his own account. In 1850 he removed to Piqua, O., and there became engaged in the business of manufacturing threshing machines, removing to Burlington, Ia. (1856), to pursue the same line of industry. In 1859 he was appointed Superintendent of the Burlington Gas Light Company, and his course in connection with that corporation was such that in time he reached the highest position in its gift, having served it for years as its chief executive officer. About 1884 he was elected to the position of President of the Monmouth (Ills.) Gas Company, succeeding the late Mr. T. A. Cosgrove. His management of the named interests was never in any degree or sense impeached. He was in attendance at the second semi-annual meeting (Cleveland, May 13th, 1874) of the Gas Light Association of the United States (now the American Gas Light Association), on which occasion he represented the Burlington Company. We believe he resigned his membership in the American Association in 1883, at which time he was prominently identified with the Western Gas Association, of which he became a member at the meeting (Third Annual) held in Indianapolis, 1880. He was very loyal to the Western, being a frequent attendant at its meetings, and participating freely in the technical side of its conventions. He served on the Western's Board of Directors during 1880-1881, and again during 1883-1884. He was also prominent in the attempt to organize and maintain a State Association in Iowa. He was united in marriage (Lebanon, Ohio, 1841) to Miss Amanda J. Matthews, who survives him, as do six children. Mr. Spencer, although a man of pronounced opinions, had the love of his family, the affection of his intimates and friends, and the respect of his fellow citizens. In closing this brief notice, for the main facts in which we are indebted to Mr. E. D. Clary, of the Burlington Company, we reprint the following sentence from a sketch of his life given in a local paper: "Of Mr. Spencer's life in this community only one thing can be said—that he lived and died honored and respected for his integrity and singleness of purpose."

A Creditable Exhibit.—A very creditable display at the exhibition by the American Institute, now in progress in this city at the Madison Square Garden, is that under the auspices of the Otto Gas Engine Works. The Otto folks show one of their latest type of 36 actual horse power engines, one special electric light engine of 13-horse power, and several smaller examples. They further show two new types of marine engines, of 25-horse and 4-horse, respectively, and a third diminutive marine engine, made entirely of brass. Although this engine weighs only 125 pounds, it is nevertheless capable of developing 2-horse power. The Otto Company, it is needless to add, will be pleased to welcome any gas man who sees fit to visit the Garden.

Material and Tools for Main and Service Laying.

[A paper read by MR. E. H. MILLARD, of Durham, before the North of England Gas Managers' Association.]

It is utterly impossible with such subject matter as is covered by the heading of this paper, to introduce anything of a startling or novel character. Yet it is well, at times, to compare methods of doing the same thing; and I am hoping that a good discussion will ensue, in which some of the older heads will give us the benefit of their experience and the results of their practice.

As to main laying, the material almost universally used is cast iron, except for the very largest sizes of mains, but there are variations in the methods of jointing; and our Association is well represented by our venerable friend Mr. Warner and by Mr. Pettigrew, who are each responsible for a patent in this direction. I am afraid I am confessing myself terribly behind the times when I state that I use only the old-fashioned open spigot and socket pipes caulked with yarn and lead; my little experience with turned and bored pipes filled with roman cement having led me to pronounce them utterly unreliable—at any rate, for a mining district or an old-fashioned town with very few straight roads in or about it. I have lately had occasion to overhaul, for the County Council, a length of 3 inch main, laid under the supervision of the County Surveyor with turned and bored joints, which had been subject to lateral displacement, and I found that nearly every joint leaked, and many of the sockets were split. The cause of the displacement was the existence of a gutter on the same side of the road at a greater depth than the main was laid, and repeated attempts had been made to render it gas-tight. I recommended the transference of the main to the opposite side of the road. But the expense was objected to, and I have tried the expedient of driving a 2-foot stake at every joint opened. I am satisfied that with the ordinary lead joint the leakage would not have been nearly so serious, and it could have been much more easily remedied.

Some years ago, to test the efficiency of turned and bored pipes, a number were put together with the sockets under water, and, on air being pumped in, bubbles were seen ascending at every joint. It requires an exceptionally good, heavy lathe to turn out joints that shall be correct, especially considering the conditions under which they are required to be produced, as to speed, the quality of metal in the pipes, and last, but not least, the price.

With respect to laying, I would draw attention to one or two points which, as far as my personal observation goes, are not by any means universally followed. The first is as to the yarn, which I prefer untarred, and which should be obtained with the proper number of strands to suit the joints of the pipes being laid, thus saving the trouble of unravelling and retwisting, and minimizing waste owing to odd strands being left about. The next is as to the lack of care in chopping down by the sides of the main with a spade when filling in. In the event of a leakage, this oversight causes difficulty in locating it, as the gas travels a long way in the loose soil under the sides of the main. I have recently been relaying a large number of mains, and, considering the years they had been down, the appearance of the bed on which the pipes had been placed came quite as a surprise.

I would also submit to your notice a very handy appliance for use when laying mains, in the shape of an indiarubber disc squeezed between two plates, and drawn along the pipes as they are laid, thus enabling each joint to be tested before filling in without any waste of gas, and at the same time making sure that no stones thrown in by mischievous boys, or waste or other material due to a careless workman, are left in the main to cause obstruction. I am indebted to Mr. Terrace for my knowledge of this appliance, which is an improvement on the canvas plug described in "King's Treatise on Coal Gas," and usually known as "drawing the badger." There is another main layer's dodge that may be new to some of you, viz., turning a beast's bladder inside out, by which means you get a smoother and better fitting skin, and add considerably to the life of the bladder. This "tip" is particularly valuable when testing mains for leakage by isolating lengths in the usual manner, and, to "make assurance doubly sure," when engaged in this work, two bladders may be used, the space between them being filled with water. In laying the smaller sized mains we joint two or more together before lowering them into the trench, using for this purpose trestles in preference to the usual low wooden blocks, which are a fearful back-breaking arrangement. These trestles also come in very handy for barricading off any of the trench left open over night.

The question as to the coating or otherwise of pipes is one which deserves consideration. Where the soil is good, I have generally dispensed with it; and I am of opinion that with coated pipes it is possible for many defects to be covered unless every pipe is inspected at the maker's works before being dipped. There is, at any rate, no reason for putting a coat on the inside, as the gas removes the whole of it; and if this were universally demanded, I see no reason why the extra charge for this method should be maintained. I remember in my early days being greatly puzzled at seeing tar pumped out of a siphon some miles from the works, while none had been observed in the nearer siphons; the explanation (which was not forthcoming at the time) being, of course, the solvent action of the gas on the coating.

Where a main is being taken up which is worth relaying, I can recommend the use of Helps' patent pipe extractor as being quicker and cheaper than bursting off in the usual way, having the sockets to clean out afterwards, and hooping the cut ends. The only points to be observed are that too great a length must not be uncovered in the smaller sized pipes, which are not heavy enough in themselves to resist the lifting action; and the workmen's minds must be disabused of the idea that the screw is to be used to actually force off the socket, in the manner of a screw jack.

For running the joint I employ clay in the smaller sizes of pipe, insisting on a roll of about 2 inches diameter, which leaves a good fillet for caulking in. In the large sizes I use the clip shown, which leaves a better fillet than the usual flat hoop.

In running a main where branches are left for proposed streets, I prefer to put into the branch a length into which a bladder can be placed when the extension is made, thus obviating the inconvenience of disturbing the gas supply, which, in these days of almost universal day demand for cooking, etc., is a feature that must not be lost sight of. Instead of inserting a plug in the socket of this length, in the usual way, I use a plain piece with a cap on the end, which affords hand hold for pulling out when the extension is made.

There has been a growing tendency to reduce the sizes of siphons and lengths of irregulars, particularly bends, which are frequently made with a knuckle. Bends swept to a radius, as used by water companies, are very much handier, as they can be cut at any length to get the exact set or angle required. If there is one thing more annoying than another it is to find that the spigots of tees, bends and other irregulars will not fit the sockets of ordinary straight pipes, or *vice versâ*; and I take this opportunity of directing the makers' attention to the point.

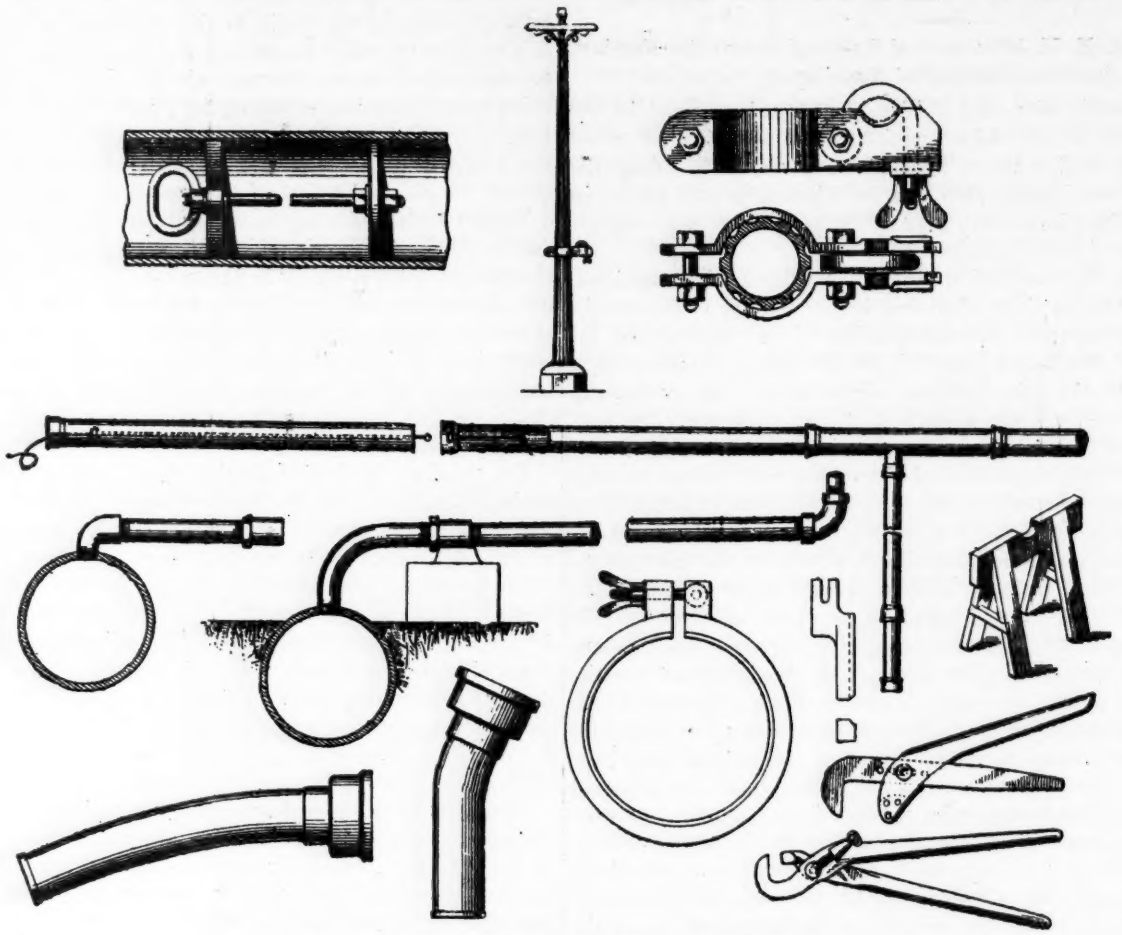
For cutting mains, the chain-wheel cutters are to be recommended as better and quicker than a hammer and chisel. I have frequently heard this challenged, but I have found that smartly rapping with a hand-hammer while the cut is being made greatly hastens the fracture by the cutters.

Coming next to the services, we are limited practically to lead and iron; but I have only had experience with the latter. "Gas" strength is rightly being gradually discarded for the "steam" quality, which offers a greater thickness of material to resist corrosion. I have tried it galvanized, but have found it to cause a brittleness; and I shall be glad to know if this has been generally observed.

With respect to the holes for services, I am afraid I am hopelessly old-fashioned, as I still use the gouge and the hand hammer in preference to the drill. My contention is that a good workman can make an equally satisfactory job in the time it would take to excavate to the extra depth for the drilling apparatus; and there is the further advantage that the main is not undermined at a critical point. This is a consideration with the smaller sizes of mains; and the solid earth also affords opportunity for putting a good solid packing under service bend. Of course, the hole must be cut small enough, and a good hexagon fluted rymer used.

I am a great advocate for good tools (of which the rymer is very important); and I consider that it pays to provide them. I have been surprised to notice in some places, not of the smallest size, that the old-fashioned stocks and dies are still employed. The cost of files knocked up in a twelvemonth in preparing ends for such tools would pay for a new set of improved stocks and dies.

I give you a sketch of a portable vice I have had made for attaching to lamp or telegraph posts. I know the usual practice is to attach a vice to a hand-cart. But Durham is a very hilly place, and, having a wide district, the men do not care for pushing the cart about; and I notice it generally takes one man to hold the cart while the other screws. The vice has proved an exceedingly useful tool, particularly for reconnecting services when relaying mains or putting a large number of services for "slot" meters in one street; moreover, it is cheap. While on this matter of tools, I would say that by far the best and handiest tongs I have come across are the "parrot-nose," with screw for adjusting the center rivet or bolt so as to take in several sizes of tubes. A very handy tool for lighter work, such as meter couplings, is the "footprint" stamp of tongs.



Tools and Appliances Referred to by Mr. Millard.

Ratchet screwing stocks are indispensable when relaying mains and services, to screw the ends of the services in position; thus saving the labor of opening a trench to the next socket. I understand to a gas manager belongs the credit of inventing this valuable tool, it being originally designed for screwing some holding-down bolts of a holder column which were too long.

A detachable joint should be, and I believe generally is, provided on every service near the main. In Durham this used to be provided by a brass barrel union, which was both costly and the cause of a considerable amount of leakage. Many provide a long screw following an ordinary bend. This appears to be waste, as the long screw can be made on the bend, thus reducing the cost, and there is one joint less. Makers would find these would be more used if they were illustrated in their lists, as well as one or two matters that are not generally known. For instance, I find barrel nipples of varying lengths, from 1½ to 5 inches, simply invaluable when relaying; and very few gas works screwing machines will screw them so close. Also male and female elbows for shallow mains, instead of a nipple and an ordinary elbow, with which it is almost impossible to make a permanently tight joint, and which I saw employed quite recently; and bends for lamps, which save the cost of a ¾-inch by ½-inch reducer. For "slot" meters, I use a ¾-inch by ½-inch malleable elbow (which is almost equal to a bend), with ½-inch gas tube upright. This considerably reduces the cost as compared with a ¾-inch steam tube right through, followed by a ¾-inch main tap.

The use of ordinary paste white lead is strictly prohibited. I dare say most of you have seen the manner in which it is thrust off when entering a socket. We employ instead a paint applied with a small brush, which is better and also saves the time, as well as the waste used for cleaning the hands. It is likewise used for painting the service pipe wherever the skin is abraded by the tongs. This simple precaution is of very great moment in prolonging the life of the service pipe, which always commences to decay at these places. Many, I know, incase the service in a troughing; but if the precautions I have mentioned are taken, and reasonable care is exercised in choosing the soil for imbedding the pipes, particularly at the gutters, "fads" of this description, with their attendant trouble and expense, can be dispensed with.

In cutting the pipes with the usual wheel cutters, I suppose one ought to rymer the tube to clear the bore from the rag caused thereby; but I am afraid this does not often get done. I adopt a halfway method of not cutting the pipe right through, and then snapping off the piece with a sharp jerk.

Closely allied with our subject is the connection between the main tap and the meter; and in the larger sizes (1 inch and upwards) there is some difficulty in getting the lead pipe neatly bent. But this can be overcome by inserting a patent steel spring, when the pipe can be quickly and neatly bent to the required form, and the spring is then withdrawn.

In conclusion, I hope none of you will go away with the idea that I have been attempting the process familiarly known as "teaching one's grandmother to suck eggs," as no one is more aware than myself of the fact that the few ideas which I have strung together, and which I in no way claim as original, are better fitted for a friendly chat in a quiet corner than for the more formal purpose of a paper. But I trust what I have brought before you may promote many such ideas. In an assembly like this, there must surely be some who have a "dodge" or "tip" worth imparting. If only one is evoked, I shall be amply repaid, and I will make a careful note of it for future use.

Discussion.

The President said the paper had been a very interesting one. Mr. Millard had taken a great deal of pains to bring with him all the various appliances named in it, and he thought they might now have a very interesting discussion.

Mr. David Terrace (Middlesbrough) said that he, along with the rest of those present, had listened with very great pleasure to Mr. Millard's paper, It was thoroughly practical, and dealt with a number of subjects such as they all met with every day. He noticed that the author mentioned the Pettigrew joints; but he might have given some slight description of these joints, because some of the members might not know what they were. Mr. Millard had also mentioned an instance of a gutter being under a main; and he thought that this was a circumstance in which he might well have put in a Pettigrew joint—a dovetailed joint. Although it might have lengthened, it would not have allowed gas to escape. For pipes laid in ground which shifted, the Pettigrew joint was really the thing that was wanted.

Mr. Millard spoke of turned and bored joints, and of very bad joints of that description. He (Mr. Terrace) used them himself, and it might be said that although they had reduced their leakage at Middlesbrough from something like 10 to about 6 per cent., it was not due to the joints. The author referred to one exceptional experience he had had, but he did not think that the leakage in this case was due to turned and bored joints. Mr. Millard mentioned his (Mr. Terrace's) name in

connection with the indiarubber disc. He was very pleased that these discs had taken hold in the North of England. It was in Scotland that he fell in with them. The late Mr. William Mackenzie, of Dunfermline, some 10 or 12 years ago, called his attention to the manner in which he was laying mains with them. The device was not patented; but it was so good that he thought Mr. Millard might have given them a better description of it. Near the end of the paper he talked as if the wood trough and the tar and sawdust for taking gas mains were a "fad." He thought it was one of the most necessary things, under certain circumstances. He did not know that those who had to work in certain soils, and who used the trough, would care to have it referred to as a "fad," because they generally found that the place which was not covered in by the trough and sawdust was the place which went to the bad. In these circumstances, he thought they were bound to respect the means which were at present in use.

Mr. M. Fligg (Redcar) considered the paper a very useful one. He was at present laying a gas main, and was using the discs Mr. Millard referred to. He found them to be very effective—in fact, more effective than the old method of putting in bladders. Anyone using them would find a great benefit from them.

Mr. G. Pettigrew (Middlesbrough) said that, as the inventor of the dove-tailed joint, he had a little to say about it. He quite thought that Mr. Millard would have made some more remarks about it. Having brought it before the meeting, he might say that over 800 miles of pipes had been laid with this joint—the Northeastern Railway Company alone had 60 miles of it. It was very useful to them, because of the difficulty they had in laying pipes along embankments and the like, where the ground was likely to settle. This joint of his tightened itself, and there was no leakage with it. Besides, it only took half the length and half the yarn, and there was a large proportion less of labor in the making of it. It stood any pressure. He had had it tested up to 7 pounds per square inch without a burst. It was evident that Mr. Millard, in sticking to the old lead joint, did not do himself justice, because he discarded the principal part of the business altogether—that was the making of a tight joint. A tight joint could not be made by the old method except at the time of their making it. The lead flowing in formed little nodules, and these were sometimes cut off, and leakage took place. But in his joint this was obviated, because any movement simply tightened the joint. He should be very glad if Mr. Millard would test his joint, and he was sure that he would never use the old method again.

Mr. T. Bower (West Hartlepool) said that all the services at Hartlepool were of lead, except a few which they used for public lamps. He was not at one with Mr. Millard in regard to his method of main laying. During his experience at Lytham, he used nothing else but turned and bored joints; and if, as had been said, the "proof of the pudding was in the eating of it," turned and bored joints must have been satisfactory, for his leakage account was very considerably under 5 per cent. He only wished that he could get the leakage account at West Hartlepool down to the same figure. Of course, this might be due to the fact that the turned and bored joints, of which Mr. Millard had had experience, had not been well and efficiently laid. He was quite alive to the fact that there were turned and bored joints and turned and bored joints; and it was one of the first requirements in their use that there should be a thorough inspection of every pipe before it was taken on to the ground to be laid, because they all knew that, however much they might caution workmen, and however careful they were, it was utterly impossible for them to get at all times the class of material they required. For this reason alone, it was necessary that they should have strict supervision before the pipes came on to the ground. But given good pipes, from his experience of both systems—extending now over a period of more than twenty years—he certainly should prefer turned and bored joints for ground where there was no liability to sinkage from mining or other operations. One of the principal reasons why he attributed his leakage to turned and bored joints was the fact of mining operations disturbing the ground. Then he would not have turned and bored joints. He had used a considerable number of the Mitford and Pettigrew joints—he had laid about 1¼ miles of water mains with them, and a better joint he had never seen. He had also laid a little over a mile of 24-inch gas mains, and there also the joints had turned out to be satisfactory. He had not used them for small pipes, but he thought that, wherever the ground was at all treacherous, they might be used with satisfactory results. He certainly thought that they ought in all joints to discard the use of tarred yarn altogether. At Hartlepool, he used nothing but plain yarn. They had about four thicknesses for different grades, and they found that they were able to make very satisfactory joints in much less time. He had had no experience such as Mr. Millard mentioned in regard to bladders, because in anything more than 6 or 7-inch mains, they used nothing but indiarubber gas bags, which they found to be much more satisfactory and more reliable than the old fashioned bladders. He used both coated and uncoated pipes. For water, he used the uncoated pipes, and for gas, coated pipes. In treacherous ground, such as they had at Hartlepool, it was of great importance to use coated pipes. Mr. Millard thought the troughing of service pipes to be old-fashioned. It might be old-fashioned, but, to his mind, it was very good; and he should not be disposed to discard it. Wherever he had occasion to lay service pipes through treacherous ground, he troughed them. His neighbor at Stockton, Mr. Ford, would bear him out when he said that, when furnace slag and the like was placed on the streets, and the street roller was passed over them, there were cases in which a ¾-inch pipe would require to be re-laid in less than three months, and in such circumstances troughing would require to be used. He had nothing further to add, except to thank Mr. Millard for bringing these matters before the Association. Some of them might appear trivial; but they were subjects with which they daily came in contact. Though they might be small, at the end of the year they would make a very large credit, or otherwise, in their finances.

Mr. J. Hall (West Pelton) said with regard to main laying, there was one thing he might mention. He had always taken great care in the packing of the joints. He preferred the white yarn. Once he made an experiment with it as to its strength, and he burst the socket of a pipe with it. This showed that white yarn was the best. The great difficulty in laying pipes was the dealing with the yarn at the lower part of the pipe. Very often the men had not sufficient room to make their joints in. For over 30 years he had had experience of turned and bored, half turned and bored, and half lead and grooved pipe joints. The latter was the most perfect joint. If grooved joints were run with lead, and the pipe began to draw, it might draw, not from one joint but from two or three. He was an advocate for lead services. He was quite astonished and surprised at the introduction of iron pipes at all, because, if they had any difficulty with their services, they would in the one case have the old lead, which would nearly buy a new pipe, and in the other case they would have nothing. In laying lead services, he believed, wood should be used in every instance.

Mr. H. Tobey (Malton) did not think they would all agree with Mr. Millard and his paper. He rather thought the author had intentionally given expression to pronounced ideas in order to bring out opposition. He did not agree with Mr. Millard in the matter of turned and bored joints. His experience was, when he took up pipes, that those which had turned and bored joints showed the least signs of leakage. Lead jointed pipes had very often shown the blackened kind of joints which denoted leakage. Therefore he concluded that turned and bored joints were much the better as regardad leakage. With turned and bored pipes, they could work round very great curves. He did not think that the depth of the turn and bore should be very great. The less it was, perhaps, the better—say, about 2 inches; and if turned slightly with a curve on it, so much the better would it be. If the ground gave way by depression, such a pipe would hold itself perfectly tight. Mr. Millard referred to putting branches into mains, for district supplies; and he (Mr. Tobey) agreed with him that it was advisable to put in a T which would meet with the wants of a district when it had grown. For services, Mr. Millard advocated a coated iron pipe, which was an advisable thing to use in some cases. Mr. Bower, where there was a bad soil, laid lead; but they had to consider the expense of laying lead pipes, which he believed to be, as compared with an ordinary ¾-inch tube, certainly about double. He did not think any of them would be in favor of laying galvanized iron pipes, because of their brittleness. He thought it was preferable to use coated pipes. Mr. Millard referred to a ratchet stop for screwing out and relaying mains. He took it that this was a very bad recommendation. It happened, as they knew, that iron service pipes got very much corroded. As long as they were left, they probably went on satisfactorily; but whenever they were disturbed, they began to cause leakage which otherwise would not exist. He had been very pleased with Mr. Millard's paper, and he should certainly make a note of the steel spring which he put into a pipe when bending it. It was a very good idea, as he had shown by demonstration on the spot. They saw how easily a pipe could be bent, and yet the full bore kept. It was certainly a thing he should adopt.

Mr. H. Lees (Hexham) said that most of the remarks so far made had been directed to the defects of Mr. Millard's paper, which was perhaps the way in which a paper should be treated, but he did not think that sufficient attention had been given to the many valuable hints contained in it. There was one point referred to which he did not know

was anything like common in the experience of main-laying. That was in regard to the sockets and spigots not fitting properly. He had had a rather unfortunate experience of this nature some eighteen months ago, which put him to some little expense and inconvenience. He got it put right; but it threw the work back further into the winter than he had made up his mind for. If this were anything like a common experience, the sooner it was referred to in the way the author had done it, the better; and he was glad that Mr. Millard had made reference to it. He also spoke of an oil stove for melting lead. Well, he had used one of them for some time, and found it very useful, especially in the case of a short length of main. It was much more convenient to take out, instead of having 2 or 3 cwt. of coke and a fire grate. The lead could be melted in the time which would be required for getting the fire ready. He thought, therefore, that the oil stove would find a very useful place in main-laying. He had also had some experience with American tools—grips, cutters, drilling machines, etc. and so far as his experience had gone, they worked very satisfactorily. But he must say that they did not appear to him to be very durable. They would have to wait, however, to see whether they were or not, and whether they were worth the money, or whether it would be better to get an English make. He had, however, found them very useful and very ingenious.

Mr. J. Whyte (Seaham Harbor) was very pleased with the paper, although, at the same time, he did not agree with Mr. Millard in all he said. For his own part, he had laid very few lead joints within the last twenty years—very few indeed. In one place where he was located, there were some turned and bored joints before he went; but he had so much trouble and vexation with them, that he made up his mind never to lay a turned and bored joint again. However, at that time the joint was fully turned on the outside. If it were a leaking joint, they could do nothing with it; but now they could. He had the opinion that turned and bored joints were now cheaper than lead joints. They simply ran the joint with lead, and they thus saved yarn and men's time. He had tried one or two; but he would never think of tying them with a ring. If they simply ran them with lead, he felt confident that they would please everyone.

Mr. Millard, in closing the discussion, said it was really refreshing to have such a discussion. He had made up his mind it would not be his fault if they had not. He had been accused, right and left, of various faults. He had been accused that he had not given a full enough description of the various things which were mentioned in his paper. He was sorry for this; but he was bearing in mind the advice which had been given—"boil it down," and he might have boiled it down too much. With respect to turned and bored joints, if the members were placed similarly to himself, and had continually to turn corners with these joints, they would not be so continually recommending them. It was all very well in modern towns, but let them try them in an old town like Durham. Mr. Bower said that, in a mining district, he should very likely not go in for turned and bored joints, Well, Durham was a mining district; and therefore Mr. Bower supported him. He had been tackled for stigmatizing the placing of service pipes in a trough as a "fad." It was a "fad." Why anybody should go to the expense and trouble of doing so, when they could do it as well otherwise, he could not understand. He did not think there were any of them who, if they could trust an iron pipe, could not trust the soil itself. Mr. Fligg, he was pleased to see, used the disc he had referred to in the paper. It was, he considered, a most admirable device. Mr. Pettigrew naturally lauded the Mitford and Pettigrew joint. It was a very good joint; but the question was whether it was worth the extra money. It was a strange thing that one-half of the meeting had been advocating joints which would taper one way, and the other half had been advocating joints which would taper the other way. He could well leave them in this position. He was very glad to see that his advice as to using untarred yarn met with approbation. With respect to the use of bladders, he did not intend that beast bladders should be applied to mains above 6 inches; but for those below this size, he defied anyone to say that a beast bladder was not out and out better than an indiarubber one. One speaker had referred to the advantage of placing the groove inside the socket. That, he believed, was pretty prevalent now. It was the joint which he was using at the present time. Mr. Tobey spoke of taking up turned and bored jointed mains. He was afraid those would be of more recent date than the lead joints to which he referred. If that were not so, he could only say that Mr. Tobey had had an unhappy experience with his lead joints. There was no doubt that lead services were very costly, as compared with iron services. Mr. Lees, he was pleased to find—at least, he sympathized with him—had had an experience of spigots not fitting sockets. He himself had had this experience several times, not with one maker only but with three or four different firms. It was most annoying. Mr. Whyte referred to the fact that he had laid nothing but turned and bored joints for twenty years. No doubt his experience of leakage with these joints would prove to be very interesting to the meeting.

[From *Engineering*, London—Concluded from page 527.]

Gas Lighting by Incandescence.

The last section is devoted to the effects of the Auer light. On the Continent, in Austria, Germany, France, etc., everybody speaks of Auer burners; here in England they pass under the name of Welsbach burners. The first point discussed is luminosity, that is, simply candle power, for Mr. Gentsch does not concern himself about diffusive power, and in most cases the paper speaks only of candle power in the horizontal plane. This is to be regretted. For various reasons we have to fix our lamps at some height, and if some type of lamps prevails over others as to the photometric measurements taken in the horizontal plane, that fact will have its scientific interest, but cannot serve as basis for a general comparison of efficiencies. Tests conducted at the Physikalisch-Technische Reichsanstalt for the Berlin Welsbach Company gave a mean horizontal luminosity of 57 candles, the maximum and minimum observed being 64 and 52, with a consumption of 112 liters of gas per hour under a pressure of 34 millimeters. The German candle is equivalent to 1.13 English standard candles, 100 liters are about 3.5 cubic feet, 112 liters about 4 cubic feet. As we shall quote the results of tests made in England lower down, it is hardly worth while to reduce all these data to their British equivalents; we have already pointed out that even their comparative value is not unquestionable. Other observers have arrived at lower and higher efficiencies. Raising the gas pressure from 20 to 40 millimeters (.8 in. to 1.6 in.), von Oechelhäuser increased the luminosity of the burners in use at Berlin by 26 per cent., of those in Vienna by 30 per cent.; the gas consumption was 110 liters. According to this observer, the mantle should be cylindrical, not narrowing towards the top, and should almost touch the burner with its lower end. Fähndrich[1] found that an Argand burner consumed 10 liters of gas per candle power, various types of Siemens burners from 6 to 3.7, older Welsbach burners from 5.4 to 5.0, new types of Welsbach burners from 2.0 to 1.5, We do not know how far improved Argands, etc., would correct these values. Renk deduced, in 1892, the following averages, feeding the Welsbach burners with 150 liters, and the others with 285 liters of gas; batswing burner, 14.27 candles; Argand, 29.61; Welsbach, 55.93. The luminosity decreases in the course of time, owing probably to two causes. In the first instance, the incandescent, soft mantle yields to the pressure of the gas and widens out so that the mantle is removed from the region of maximum heat and continues to burn under less favorable circumstances. Then specks of dust adhere to the hood, burn into it, and diminish the active surface. Fähndrich observed a decrease of 29 and 65 per cent. after 524 and 383 hours of burning; von Oechelhäuser 22.4 and 44 per cent. after 500 and 800 hours; with Berlin burners the decrease amounted to 12.4 and 16.3 per cent. only, again after 500 and 800 hours; Salzenberg found no decrease at all at the end of 400 hours, and 8 per cent. at the end of 740 hours. Muchall and Schridde report cases of remarkable longevity of mantles, 2,000 and 4,000 hours; in the last instance, the luminosity had dropped from 57 candles to 33.7 candles.

There is no doubt that with careful treatment, the delicate mantles can attain great age, and remain remarkably efficient in their old days. The new mantles are not so fragile as those of the early days, and an improvement in the chimney cylinders, from which again the public at large have profited a little, has gone hand in hand with the general development of the industry. The Welsbach mantles are now supported by a central rod of fireproof material; this arrangement is both safer and less obtrusive than the old side rod with its ring at the top. Although many hoods have done duty for over 2,000 hours, the average life claimed now is 500 hours; thus two mantles and also two chimneys ought to do for one year.

Street lamps are, of course, more exposed to concussions and atmospheric changes, and their mantles cannot be expected to last as long as they would in houses. Experiments carried on in Munich in 1893 showed that a street lamp requires a little more than three mantles a year. In Wiesbaden the maximum life observed was 1,741 hours, and Muchall[2] states that the average lives were 705 to 579 hours. These street lamps are provided with glass chimneys. The method of fixing

1. *Chemiker Zeitung*, 1893, page 1034.
2. Schilling's *Journal fur Gasbeleuchtung*, 1894, page 273.

of the lantern is not without influence; brackets have answered far better than pendants. At Munich the Welsbach street lamps had originally—in December, 1894—been placed 45 meters (49 yards) apart; they were afterwards erected at distances of 41 yards. Tests as to surface illumination have been made at Munich.[2] We quote the results obtained at various angles in meter candles, that is to say, the illumination which one standard candle (1.13 British candle) would impart to a white surface at 1 meter distance; the values refer to planes at right angles to the respective rays:

	Welsbach Burner.	Ordinary Burner.
Angles of 30°	0.86	0.35
" 40°	1.19	0.58
" 50°	1.36	0.74
" 70°	1.29	1.10
" 80°	0.89	0.90

On the results of these experiments, Schilling recommended to place the lanterns 82 ft. apart, and to provide each with three Auer burners. This suggestion has been adopted in one of the main streets of Munich. Our readers may remember that the town of Munich has decided in favor of the electric light. This fact does, however, not suggest dissatisfaction with the gas light. Electricity has been adopted for various purposes, both for light and power. Insects have, of course, caused some trouble in the street lanterns. They gain access through the air passages, and, doomed to instantaneous death, get their revenge afterwards. The evil can be remedied by putting wire gauze over the passages, which, however, has to be looked after and cleaned.

About the sanitary aspect of the question, M. Gentsch has not much to say. It is satisfactory to learn that Renk could not discover any carbonic oxide in the combustion products even at the end of 13 hours; the method employed would have indicated one part of this much dreaded gas in 20,000. These experiments are supposed to dispose of Gréhant's assertions to the contrary. When we are informed by Renk that an Argand burner increased the amount of carbonic dioxide by 3.394 parts per mille at the end of four hours, whilst an Auer burner produced an augmentation of 1.427 parts only, we want to know the gas consumption, which is not stated. The incandescent mantle does not radiate much heat; von Oechelhäuser could not observe any effect of heat radiated at a distance of about 2 ft. from the lamp. In the early days of the electric incandescence lamp, we were always assured that we received light without heat. Within the last years several inventors have secured patent rights for heating water, etc., by means of incandescent lamps. Perhaps the heat emanating from a Welsbach burner will be more appreciated some day. For the illumination of lecture halls, drawing class rooms, for which the incandescent light is no doubt fitted, we need a well and properly distributed light. Renk has published a table on the comparative illuminations produced by an Argand burner of 25.5 candles, and a Welsbach burner of 52.4 candles. The illuminations are expressed in meter candles:

	Argand.	Welsbach.
Under the lamp	33.71	45.38
19 inch aside	24.73	35.26
39 " "	11.46	17.71
58 " "	5.36	9.96
78 " "	2.50	6.00

These numbers show a more uniform distribution of the light in the case of the Welsbach burner, as was to be foreseen, but are not otherwise favorable to that system. As regards screens, Renk has ascertained that milky glass absorbs more of the incandescence rays than ground glass.

Cost estimates by Lang of lighting by electric glow lamps, ordinary, and Welsbach gas burners, conclude these articles; they are to establish the superiority of the latter system of lighting. We need not enter into these estimates. It will probably be admitted that the incandescence gas light will prove cheaper than the ordinary gas light, when a brighter, stronger, cleaner, and steadier light is desired. But so many and manifold improvements have been effected in gas lighting, that so vague a term as "ordinary" gas light hardly has any right of existence. Where people are satisfied with the common burner of, say 12 candles, it matters little whether burners arranged on a different plan would spend 50 candles at comparatively less cost.

Mr. Gentsch's articles cover 34 pages, and are illustrated by 68 figures. The author has a very pronounced preference for the Auer light, and every section opens with a eulogy of the merits of Dr. Auer von Welsbach. This duty discharged, he speaks very much to the point, and his articles will form a valuable contribution to our literature on the incandescence gas light.

2. *Ibid*, 1893, page 608.

We wish to add a few remarks on a report published in January, 1895, in the *Lancet*, "The *Lancet* Special Analytical and Sanitary Commission on the Incandescent System of Gas Lighting." The report comes from the *Lancet* laboratory; the investigators of the "incandescent" system are not named. The vitiating and heating effects of various burners were determined in a room 10 ft. by 6 ft., 10 ft. high, with two lamps fixed at a height of 6 ft., 9 ft. apart at the ends of a diagonal; the one oil lamp tested was placed on a table. The results are rather curious. The air contained originally six parts in 10,000 of carbonic acid, and had a temperature of 53° F. Observations were taken after one, two and three hours, at 1 foot below the ceiling (I.) and at breathing level (II.). Two Welsbach burners gave, after the one, two, and three hours. I.: 67.2, 77.9, 80.5 parts of CO_2 at temperatures of 68, 76, and 81°; and II.: 10.5, 17, 18.2 CO_2 at 59, 63, and 65°. Two Welsbach burners without mantles gave I.: 54.9, 56.5, 63.1 CO_2 at 75, 78, and 80°; and II.: 23.2, 36.8, 32.9 CO_2 at 63, 64, and 65°. The mantles would thus appear to produce a slight rise in temperature, but keep the air at breathing level purer, the carbonic acid evidently found means of escape. Two Argand burners yielded I.: 93.1, 117.6, 119 CO_2 at 79, 84 and 89°. II.: 38.6, 48.6, 50.2, CO_2 at 65, 68 and 72°; and two Bray batswing burners: I.: 84.1, 108.2, 115.7 CO_2 at 78, 89 and 95°. II.: 37.6, 46.6, 47.4 CO_2 at 59, 65 and 69°.

The two Welsbach burners consumed together 7 cubic feet per hour, the others 12 cubic feet; the aggregate candle powers were: Welsbach, 50 + 40; Argand, 16 + 16; Bray, 9.6 + 9.6. From these data we derive increase of temperature and of carbonic acid per candle power: Welsbach, 0.116°, 4.8 parts in 10,000; Argand, 0.590°, 1.900; Bray, 0.807°, 2.86. Taking means per cubic feet of gas, we obtain, of course, approximately the same values in all three cases: Welsbach, 1.5°, 4.8 parts of CO_2; Argand, 1.5°, 5.0; Bray, 1.3°, 4.6. The tests thus establish a superiority of the Welsbach light if we base our comparison on the candle power. In other words, the Welsbach burner yields comparatively more light per cubic foot of gas consumed, provided we are prepared to put up burners of 50 candles requiring about 4 cubic feet of gas per hour. This is what we pointed out above. For feebler lights we have no standard of comparison. We must not expect better light and a reduced gas bill at the same time. The *Lancet* Commission also inquired into the presence of carbonic oxide and acetylene—the now so much mentioned hydrocarbon C_2H_2—in the combustion products. The results were negative in all cases. The last fact, the non-detection of carbonic oxide, is very satisfactory so far as it goes; it is a much contested point. Every student of elementary chemistry can discourse on the poisonous character of this compound, and yet it has required the noble researches of Dr. Haldane to teach us what really kills most of our poor miners in colliery explosions.

A few words in conclusion concerning the rare earths. When once a use had been found for them, the search for their minerals soon established that they deserve their qualitative "rare" in a limited sense only. For some time the Norwegian thorite, a silicate, was practically the only material for thoria, which makes up about half of its weight. On further inquiry, thoria has been discovered in a good number of Norwegian minerals, mostly silicates, which form the subject of an able monograph by Professor Brögger, "The Minerals of the Syenite-Pegmatite Veins of the South Norwegian Augite and Nepheline Syenites. At present the manufacturers of the incandescent hoods rely chiefly upon monacite, which, first also known in Norway, now comes over in shiploads from the abundant layers in Russia, North Carolina and Brazil. But this monacite, essentially a phosphate of rare earths, only contains about 8 per cent., sometimes as little as 3, of the particularly valued thoria. The question then arises, What are we to do with the bye-products, mixtures of ceria, didymia, lanthana, etc.? Dr. Otto Witt is investigating this subject. As yet the oxalate of ceria alone had found a certain unimportant application in medicinal practice. The double nitrate of cerium and sodium, one of the few stable compounds of this metal, colors glass yellow, and has also given satisfactory results as a mordant.

The Rey Gas Engine.

The *Gas World* says that a gas engine has been devised by M. Rey, of the French Polytechnic School, in which the slide valve, the single cylinder, and a four-cycle have been retained, but in which the order of events in the four-cycle is the following: (1) Introduction of pure air (instead of gas and air mixture); (2) instead of compression simply we have, firstly, expulsion of a part of the air just introduced; secondly, introduction of the gas, and thirdly, compression of the mixture; (3) and (4) explosion and escape, as in the ordinary four-cycle. By this arrangement the same quality of gas may be made to work in a much larger cylinder, so that the energy of the explosion is more effectively turned to account; and it is reported that with this engine the consumption of gas is reduced to 12½ cubic feet per horse power.

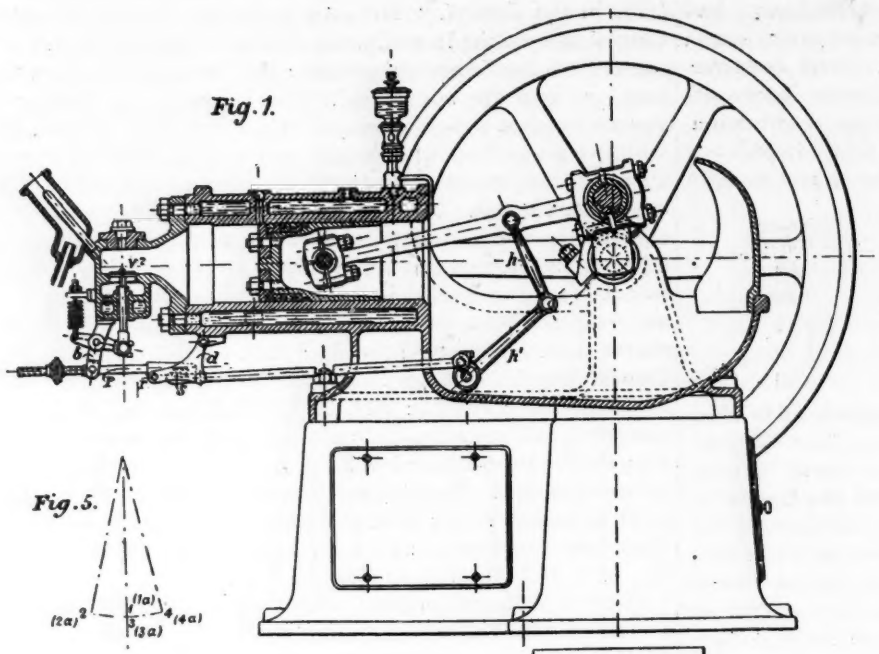


Fig. 1.

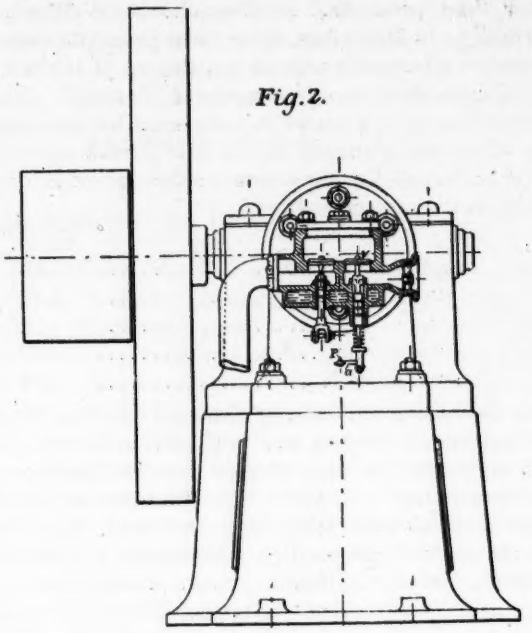


Fig. 2.

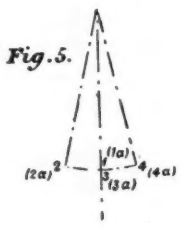


Fig. 5.

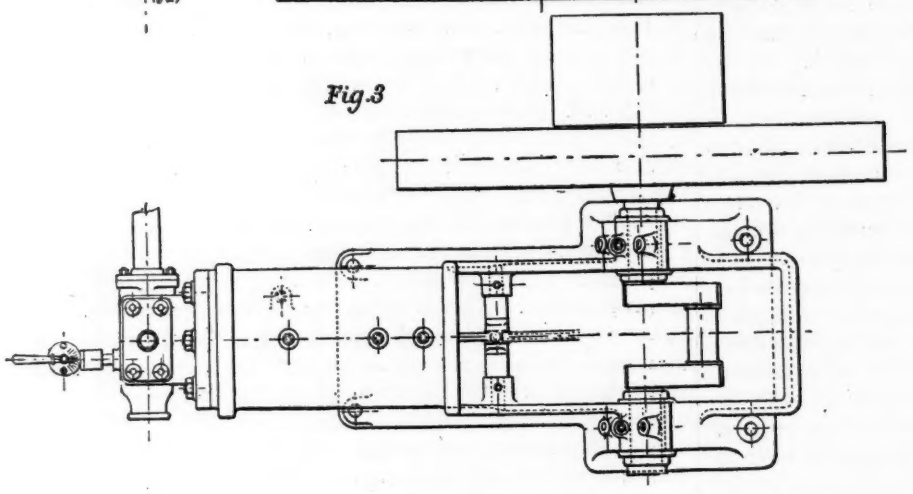


Fig. 3.

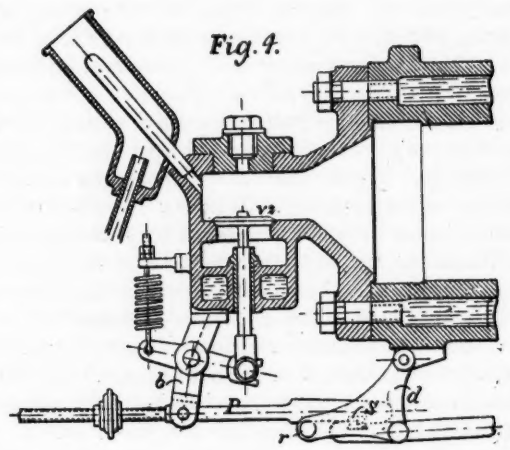


Fig. 4.

The Borsig Four-Cycle Gas Engine.

Engineering reports that Mr. A. Borsig, of Berlin, is exhibiting at the Berlin Exhibition a four-cycle gas engine, which is noticeable from the absence of toothed wheels, eccentrics and the like. The general appearance of the engine, as shown in Figs. 1 to 3 above, follows the usual lines, but the valves are worked by a kind of radial gear h, h^1, the principle of which is illustrated in Fig. 5.

The path 1, 2, 3 of the die or catch s corresponds to the suction period; the path 3, 4, 1 to the compression period; the path $1a$, $2a$, $3a$ to the expansion period; and the path $3a$, $4a$, $1a$ to the period of exhaust.

During the period of suction, first cycle 1, 2, 3, the pendulum pawl P is lifted by the lateral projection a (Fig. 2) of the suction valve v; when the valve closes, P slowly falls back to be caught by the die s; on the path 3, 4, 1, s runs, therefore, idly. On the path $1a$, $2a$, $3a$, s slides under the corresponding edge of P, opening the exhaust valve v^2 while it follows the path $3a$, $4a$, $1a$. Thus the four-cycle is completed.

When the motor exceeds its speed, the pendulum pawl P is, by the action of the roller r of the suspension link d, thrown up too high, and falls in too late, missing s. The exhaust valve then remains closed; the expanded mixture is once more compressed and expanded, and this play is repeated until the motor has regained its normal speed. Then the pendulum pawl will again act, the exhaust valve will be opened, the exhaust will escape, and suction again take place on the up-stroke, after which the normal conditions will continue.

Oil and Ozokerite Deposits in Russia.

From time immemorial the island of Cheleken has been famous for its oil and ozokerite deposits. This island is situated in the southeastern part of the Caspian Sea, being separated from the mainland by a narrow channel, and having an area of about 700 square miles. The interior of the island is an uninhabitable desert, only along the shore there a few isolated settlements of semi-barbarous Turcomans who have probably been forced to emigrate to this desolate spot from the plains of Central Asia. According to a recent German report, the oil is forced to the surface by numerous springs of hot sulphur water (102° F.), and accumulates in wells dug by the Turcomans. Long before European prospectors set foot upon the island, the natives were engaged in the production of oil and ozokerite. The ozokerite was separated from the rock by melting, and sold in the market of Baku. The oil was skimmed off the surface of the water, placed in leather bags, and taken in skiffs to Asterabad, in Persia. This mode of transport was very dangerous, for the Caspian Sea is rather a treacherous sheet of water, and many a Turcoman engaged in this business never came back again. It is estimated that the quantity of oil produced by the Turcomans during the sixties and seventies amounted to 100,000 pouds, or about 12,000 barrels. In 1876 the first attempt in the direction of a rational exploitation was made by Palankowski, a well-known operator of Baku. The attempt, however, did not result successfully, because the upper sands were almost exhausted by the diggings of the Turcomans. The operations commenced by Nobel Brothers, in 1881, were also stopped after a short time, partly because of lack of labor (as the Turcomans refused to work), partly on account of the intention at that time to concentrate the production and manufacture of petroleum on the Apsheron peninsula (Baku). This field was then forgotten, until quite recently the attention of the prospector has been called again to the island, especially by the authorities of the Trans-Caspian territory, who were looking for a cheap liquid fuel for the Trans-Caspian Railway, and caused the resumption of operations on the island, which were accompanied by favorable results. The firm of Nobel Brothers has now resumed digging operations. Analytical tests made in the laboratory of the Technical Committee of Baku have shown that the crude oil of Cheleken Island possesses very peculiar properties. It is of thick consistency at 9° C., like salve, and becomes solid at a little below 0° C. Its water content is hard to eliminate, and this circumstance proves a serious obstacle in the distillation. Its specific gravity at 15° C. is 0.868, the flashing point 51.5° C. The residue possesses, at ordinary temperature,

22.5° C., the consistency of salve or jelly, a specific gravity of 0.900, and can be worked up directly to vaseline.

Another characteristic of this oil is its high content of paraffine, it amounting to 5.5 per cent., which, after being refined, furnished about 3 per cent. of white amorphous paraffine wax. This shows that the crude oil forms a sediment even at not very low temperature. From a sample of crude oil two kinds of illuminating oil were produced, the first kind possessing all the properties of American illuminating oil. It gave a very bright flame at the beginning of the burning process, but the brightness declined greatly towards the conclusion of it. The second kind did not burn so well as the first. By mixing both kinds, a third one was produced, possessing 0 800 specific gravity with the flashing point at 35° C., which burned very satisfactorily. It is stated that the illuminating oil of Cheleken differs from the American article only in its higher flashing point.

Coke Production of Alabama.

[From report on "Manufacture of Coke in 1895," by Mr. Jos. D. Weeks, to the United States Geological Survey.]

Alabama again assumes the position it held from 1889 to 1894 as second in amount of production of the coke producing States. West Virginia, which exceeded it in production in 1894, drops again to the third place, Pennsylvania still holding first rank.

The coal fields of Alabama are divided into three sub districts, known as the Warrior, the Coosa, and the Cahaba, these districts being named from the rivers which drain them. Coke ovens are built in all three districts, but coke was made in 1895 in but two—the Warrior and the Cahaba. The most important of these districts, both as a coal producer and coke maker, is the Warrior. the ovens of this district being located near Birmingham. Of the 5,658 coke ovens in Alabama, 5,024 are in the Warrior district, and of the total production of 1,444,339 tons of coke in 1895, 1,405,439 tons were made in the Warrior district.

While most of the ovens built in this State are of the ordinary beehive pattern, the more recent ones being of the usual dimensions, 12 feet in diameter and 7 feet high, it is evident from the frequent attempts that have been made to introduce other ovens that the beehive oven as a coker of Alabama coal is not entirely satisfactory. The ovens other than beehive, which have thus far been introduced successfully into Alabama, are solid wall ovens, or ovens in which there are no flues in the walls, and in which the coking chamber or combustion chamber, wherein the heat for coking is produced, are the same. Two forms of these modified solid wall ovens are in use in Alabama at the present time, one known as the "Thomas" oven, which has already been described in this series of reports, and the other as the "double oblong." These ovens are 21 feet long and 9 feet wide, open at both ends. The ovens are charged from the top and drawn at the ends. They produce in a given time some 75 per cent. more coke than the ordinary beehive oven.

. The following are the statistics of the manufacture of coke in Alabama from 1880 to 1895, inclusive.

Statistics of the Manufacture of Coke in Alabama from 1880 *to* 1895, *inclusive:*

Year.	Establishments.	Ovens. Built.	Ovens. Building.	Coal Used. Short Tons.	Coke Produced. Short Tons.	Total Value of Coke at Ovens.	Value of Coke at Ovens. Per Ton.	Yield of Coal in Coke. Per Cent.
1880.	4	316	100	106,283	60,781	$183,063	$3.01	57.
1881.	4	416	120	184,881	109,033	326,819	3.00	59.
1882.	5	536	..	261,839	152,940	425,940	2.79	58.
1883.	6	767	122	359,699	217,531	598,473	2.75	60.
1884.	8	a976	242	413,184	244,009	609,185	2.50	60.
1885.	11	1,075	16	507,934	301,180	755,645	2.50	59.
1886.	14	a1,301	1,012	635,120	375,054	993,302	2.65	59.
1887.	15	1,555	1,362	550,047	325,020	775,090	2.39	59.
1888.	18	2,475	406	848,608	508,511	1,189,579	2.34	60.
1889.	19	3,944	427	1,746,277	1,030,510	2,372,417	2.30	59.
1890.	20	4,805	371	1,809,964	1,072,942	2,589,447	2.41	59.
1891.	21	5,068	50	2,144,277	1,282,496	2,986,242	2.33	60.
1892.	20	5,320	90	2,585,966	1,501,571	3,464,623	2.31	58.
1893.	23	5,548	60	2,015,398	1,168,085	2,648,632	2.27	58.
1894.	22	5,551	50	1,574,245	923,817	1,871,348	2.025	58.7
1895.	22	5,658	50	2,459,465	1,444,339	3,033,521	2.10	58.7

From the above table it appears that the total production of coke in Alabama in 1895 was 1,444,339 tons, as compared with 923,817 tons in 1894; an increase of 520,522 tons, or 56 per cent.—a most remarkable showing. The production of coke in 1895 was the largest in the history of the State with the exception of 1892, when some 1,501,571 tons were produced, only about 60,000 tons more than was made in 1895.

The number of establishments remains the same; one establishment has gone out of existence, but another has taken its place. There has been an increase in the number of ovens of 107. The yield of coal in coke remains the same. The increase in the price of coke, however, was but slight, the average value as compared with 1894 having increased but 7½ cents a ton.

Another notable feature in the manufacture of coke in Alabama is the greatly increased amount of washed coal that is used. In 1891 but 8,570 tons of washed coal, all of which was slack, were used in the manufacture of coke in this State out of a total of 2,144,277 tons. In 1895, however, of the total consumption of coal in coke of 2,459,465 tons, practically one-half was washed, or 1,219,377 tons. All but 32,068 tons of the slack used were washed. From reports received it appears that this washing has greatly improved the character of the coke made in this State. It has not only reduced the ash and sulphur, but the physical structure of the coke has not been injured, if, indeed, in many cases it has not been improved by the washing.

A New Method of Detecting Waste of Power in Electric Railways.

By Mr. Harold P. Brown, in *Electrical World.*

Our mechanical engineers during the past few years have so perfected the steam plant in the railway power houses that there seems little margin for further improvement. The motor and dynamo designers have pushed their art to its utmost economical limits, while the electrician claims to have used ample section of copper in trolley feeder wires. And yet the amount of power delivered by the dynamos is out of all proportion to the power actually utilized at the car axles. There is a large loss somewhere, and the object of this paper is to give railway electricians a new and simple method of proving its existence and of definitely locating it; the correction of the evil is a later consideration. Many managers claim high efficiency for their power plants, and the ordinary forms of station records seem to justify their faith. But Mr. Thomas Henning has recently called attention to the injustice of using "car miles" as a basis for comparison between different power houses, since the weight and speed of cars, the grades, the distances and the line losses are not considered.

The only fair basis for such comparison is the coal consumption per kilowatt delivered by the dynamos. The relation between the number of watts generated and the number of watts used by the motors should, of couse, give the electrical efficiency of a railway. This efficiency can be approximately determined by taking hourly records of watts generated and dividing by the number of cars in actual service during each corresponding hour, thus obtaining the watts developed per car. From averages of wattmeter records the power required by a standard car on each line at time of light and heavy loads can be determined and the average efficiency obtained. Or, knowing average weight of cars, average speed and efficiency of motors, the watts per car can be closely calculated. In this manner the power efficiency of several leading roads has been found by the writer to be less than 45 per cent. at heavy load. Each of these roads has a finely equipped power plant, multipolar dynamos, modern types of motors, with series-parallel control, excellent tracks and apparently ample feeders.

The management of each company had willingly spent thousands of dollars to obtain economical production and distribution of power and felt proud of their equipment. Convinced that the trouble was caused by poor rail returns, the problem was to prove it, first to myself and then to them. On one road a double track of 90-pound girder rail passed the front of the power house and led to the meeting point of 10 or 12 similar lines, having a total consumption of about 8,000 amperes.

These rails have been in service about 18 months, and each joint had two Chicago bonds 8 inches long and 0.43 inch in diameter.

The bonds had been carefully applied by a competent mechanic. Examination showed that they were perfectly tight and in apparently good condition. Tests made with a Weston instrument reading to 0.01 of a volt showed very slight deflection at these joints. The drop was small with 100 or even 500 feet of the rail. And yet at time of heavy load the pressure between trolley wire and rail was very low.

In a conduit below these rails was a feeder of 1,000,000 cm. section, with taps to the rail at every manhole. The pressure rose at the taps but quickly dropped in a few rail lengths. Readings were made at heavy load throughout each line and the pressure found everywhere low, though the trolley feeders were generally of ample section and the drop at rail joints small. An insulated rail feeder of 1,000,000 cm. was

connected to a line from which 700 amperes should return. At the point of contact the pressure was normal, but dropped within a few hundred feet, and only 60 to 75 amperes returned by the feeder, while the current on the gas and water pipes was enormous.

It was impossible to account for the existing conditions except upon the theory that the rails were not doing their proper duty and the pipes were consequently overloaded. To determine this the writer ordered from the Weston Company a special milli voltmeter reading to 0.0001 of a volt. When this instrument was received a piece of the 90-pound rail was taken to the power house and put into circuit with a rail feeder and an ammeter. The drop of voltage in 1 foot of the rail and the current through the same were noted. The rail resistance was found to be 0.00001 ohm per foot, and a constant was obtained by means of which the current through any similar rail in service could be determined on the street by noting with the same instrument the drop in 1 foot. Measurements were then made upon the line passing the power house, and each rail was found to be carrying but 25 amperes instead of the 700 to 1,000 which would be its proper load.

A similar low-reading instrument was connected at the rail joints, and the drop was then shown to be entirely too large for the very small current transmitted. In making our previous measurements of drop only, when we assumed a heavy current flow the low reading gave the bond a certificate of great efficiency, but when the current was simultaneously measured and found to be insignificant, the high resistance of the bonds was no longer concealed. Quite a number of the bonds were removed for examination. All were found to be mechanically tight, but the contact surfaces of the copper and of the steel proved to be entirely covered with a black, greasy deposit.

This was the secret of the great waste of motive power, the cause of the heavy load upon the pipes, and the origin of electrolytic corrosion of cable armor and of gas and water mains which had given so much trouble. As some of these pipes carry natural gas at high pressure, I am waiting with great anxiety for the remedy to be applied.

A leak in a wrought iron natural gas pipe is so easily started by electrolysis, it is so hard to detect and locate, and so apt to cause frightful explosions, that a load of 300 to 400 amperes on an 8 inch pipe is not a pleasant thing to contemplate. This same milli-voltmeter will, of course, indicate from the drop in 1 foot of pipe of known weight the exact number of amperes carried. Only a few weeks ago, in opening a natural gas pipe in the same city, the spark between the parting ends ignited the gas, and one of the men was badly burned. Fortunately the gas pressure had been turned off or he would have been cremated.

In work of this kind a heavy copper cable should be clamped upon bright contact spots on each side of the joint before the pipe is opened. The delicate Weston instrument by the very simple test above described proved that fully half of the loss of power had been caused by a film of oxide on the contact surfaces of the bonds; it showed that the best copper bonds lost their efficiency in less than two years; it demonstrated that in this particular plant a large portion of the investment in engines, boilers and dynamos could have been saved had the rails been available as conductors in their entire section. This result electric rail-welding attempted to secure, but aside from the now well-known mechanical effects of the process, the presence of the flux between the welded surfaces caused a high resistance which the milli-voltmeter detects. I have not yet made sufficient numbers of measurements of these joints to publish results.

But I have already tested several hundred cast-weld joints which have been in service about 18 months. These joints are also bonded with copper wire, but the drop of 1 foot of rail including the joint averages from 3 to 10 times that of a foot of rails between joints.

The current carried by the rails is also small and there are occasional joints with as much as 1 volt drop.

I have seen a report of test of a sample cast-weld joint which had never been underground nor in service, in which was used a voltmeter reading 0.01 per degree, while the observed drop was expressed in decimals to the fourth place! Also another test with same instrument, in which the drop of about 2,000 feet of double track was measured with less than 120 amperes current, from which it was apparently assumed that the current flowed upon two rails only, and that none was carried by crossbonds, by the earth or by pipes underneath. Here again the result is expressed in decimals beyond the reach of the instrument!

I have personally gone over miles of track having this joint, taking readings to 0.0001 of a volt, measuring drop of 1 foot of rail including joint, and of 1 foot of same rail away from joint, and I am forced to conclude that the character of the iron, of the climate or of the instruments used account for the widely differing results. My tests show that while this joint is mechanically most excellent, it is not a permanent bond and does not show a low resistance on at least one road. An electrically continuous rail is certainly very desirable. The metal is required for mechanical purposes; the electrical use of its entire section would give to its owners the service rendered by 1,000,000 cm. of copper weighing 16,000 pounds per mile for each line of 90-pound rail.

Its conductor value in terms of copper equivalent would exceed $1,900 per mile for each rail. It would largely reduce the transmission losses and thus diminish the necessary power investment, or it would correspondingly decrease the amount of copper required as trolley feeders at a given percentage of loss.

With this in view, is it wise for engineers and managers to be content to have their magnificent conductors left in lengths of 30 to 60 feet, electrically joined by mere strips of copper whose contacts are entirely inadequate even when new, and whose low efficiency is rapidly decreased in service? Is it not worth their while to at least get a pair of these low-reading Weston instruments and definitely determine how much current is carried by their rails, how much energy is lost at the joints and how much injury is inflicted upon the underground pipes?

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NOLTON H. HUMPHRYS.

SALISBURY, ENGLAND, October 10th, 1896.

Gas Business in London—The Flow of Fluids Through Pipes—The Products of Combustion of Coal Gas.

The effects of the introduction of the automatic prepayment meter upon the annual statistics of the London Gas Companies are attracting attention in quarters outside regular gas circles, giving an illustration of the close scrutiny that is directed upon our industry by persons interested in other modes of lighting, and of the eager desire that exists towards pouncing upon something encouraging to the languishing electric light business. In a recent issue of the *Engineer*, an excellent serial devoted to the topics indicated by its title, attention is directed to this matter under the heading of "A Change in the London Gas Supply." The writer appears to have been strongly impressed with the fact that although the aggregate consumption of gas in the metropolis increases year by year, the average consumption per consumer tends to decrease, as shown by the results of the last four years' working, and draws several deductions from this interesting fact, some of which are obviously true, whilst others will not bear investigation, and are simply assumptions. In the year 1892, the three principal Gas Companies that supply the city of London mustered approximately 320,000 consumers. Between that period and the end of 1895, about 80,000 automatic meters were added, bringing the aggregate up to 400,000. In 1892 the average consumption per consumer was about 82,000 cubic feet per annum, and the effect of adding 20 per cent. of small consumers that would average something under 20,000 cubic feet per annum is just what might be expected, viz., that the annual consumption per consumer is reduced to 69,500 cubic feet for 1895. This diminution is most marked in the case of the South Metropolitan Gas Company, which has appropriated about one-half of the "penny-in-the-slot" trade, with the result that the average consumption has fallen from 79,000 cubic feet in 1892 to 57,500 in 1895. In the case of the 12 Companies that supply the suburbs of London, the aggregate consumption increased from 4,200 million cubic feet in 1892, to 4,800 million cubic feet in 1895, but the average consumption per consumer fell from 60,500 cubic feet to 57,000 cubic feet.

These figures, if they prove anything, show that the actual conditions as regards consumption per consumer remain practically the same as they were in 1892. If we take 80 per cent. at 82,000 and add 20 per cent. at 20,000, the result comes out as 69,600. Comparing this with the 69,500 shown by the statistics, we find that, after a liberal allowance for the slot meters, the consumption per consumer is the same in 1895 as it was in 1892. There are no figures available showing the number of slot meters, or the consumption per consumer in that class of business in the suburbs. But as the number of consumers in 1892 was 66,000, and one Company alone, the Tottenham and Edmonton, owns to having put in over 3,000 slot meters in the last three years, it is evident that the introduction of these appliances is more than sufficient to account for the slight reduction in the average consumption per consumer that is above recorded. Had the results been otherwise, and a margin remained after reasonable allowances for the small consumers, it would be possible to say something about the number of burners sold by the Incandescent Gas Light Company. But it is obviously unnecessary to cast about for causes to account for an element that does not exist. Evidently the introduction of the electric light and the Welsbach gas burner has no disturbing effect on the gas business.

But this is not the view of the writer in the *Engineer*. After remarking upon the introduction of gas into the new fields, etc., he begins to run wild in the endeavor to work in the electric light. The Chairman of the Gas Light and Coke Company has stated on more than one occasion that no loss of business has been experienced in the districts where the electric light was most popular. This was in reference to the West End of London, where the new illuminant has been more generally introduced than in any other part of the country. The statistics just quoted show the correctness of this assertion. But our contemporary falls into the error of supposing that, apart from the slot meter, there is a large deficit per consumer to account for, and that the gas companies, alarmed by loss of business, have rushed for the slot meter, and draws a graphic picture of gas "going down one" to make room for the electric light. The facts of the case are different. The slot meter was put on the market for the first time in 1892, and its adoption was immediately forced on the Companies by the popular demand. So far from doing anything in the way of pushing this instrument, they cannot get the makers to turn them out fast enough to cope with the orders that come in. Gas Companies have certainly secured a large additional business, but there is nothing to show that they have lost any of that which they held in 1892.

Apropos of the slot meter, I happened to meet with an intelligent London artizan some time ago, who gave me a very accurate account of the working of this new system. Like many London people. he appeared to imagine that this new idea was not known much in the provinces yet. But he also volunteered the information that he was charged 9d. per 1,000 cubic feet more than the regular price as a rent for the meter and fittings, and expressed an intention of buying his own fit up and becoming a *bona fide* quarterly consumer. As he was an example of about 100,000 in London alone, I could not help being struck with the probability that demands for some concession to the slot consumer will not be wanting, and it is questionable whether he will be inclined to bear the burden of the large additions to capital which he has been the means of introducing. The reduction of the consumption per consumer, together with the increase of distribution capital, must tend to increase the distribution and establishment charg s per 1,000 cubic feet of gas sold. So a large proportion of slot consumers is not likely to conduce towards gas at the lowest possible price.

It is somewhat remarkable that although several investigators have directed their attention to the flow of gas through pipes, including the quantity delivered per hour through mains of various diameters and lengths under varions pressures, no one seems to have thought it worth while to examine the obstruction offered by bends, elbows, tees, crosses and other fittings in everyday use. Runs of straight pipe are the exception and not the rule, and although it is the usual practice to dis pense with bends and curves as far as possible, no one is able to do without them entirely. It is therefore interesting to learn that experiments have been in progress for some years past, in connection with the engineering department of the Yorkshire colleges, with a view of as certaining the effect of the connections in general use, as regards the head of water delivered through them. The results are stated in diameters of straight pipe, and it is found that the irregularities incidental to a socket joint have a retarding effect equal to about 16 di ameters of plain pipe. Easy right angled bends are equivalent to 10 to 15 diameters, but right angled elbows to 30 to 36 diameters. A bulb or enlargement had a very slight effect. Assuming that these conditions also apply to gas, it would appear that in straight pipes of small dimen sions an addition of 30 to 50 per cent. should be made to the actual length to compensate for the joints; that the "elbow" should be disregarded entirely, and that bends should be substituted, having as large a radius as practical conditions will allow. The form of the tee may also be modified by introducing a curved branch in place of the stiff right angle or upright. These experiments might be extended with advantage to embrace the effect of introducing double sweeps, or the usual forms of curve adopted to clear an obstruction, either by perpendicu'ar or horizontal deviation from the line of pipe. It is surprising how much successful work in the way of distributing gas has been done, when we remember the paucity of information available on these important matters.

Some researches have lately been carried out in the Physiological In stitute, at Christiania University, Norway, on the products of combustion of coal gas and their effects upon health. The ordinary supply to the town was used, and the average composition of this was found to be: Hydrogen, 47; methane, 36; heavy hydrocarbon, 4; carbonic oxide, 8; carbonic acid, 2; and nitrogen, etc., 3. The sulphur compounds averaged 30 to 35 grains per 100 cubic feet. From this it would appear that the illuminating value of the gas was not very high, while the purification was anything but first rate. Two per cent. of carbonic acid and 30 grains of sulphur per 100 cubic feet would be sufficient to condemn the gas in any of the principal towns in England. Batswing, Argand and Welsbach burners were used, and the products of combustion were carefully examined and analyzed with a view of ascertaining the completeness or otherwise of the combustion, and also whether other substances were formed which might have hitherto escaped detection. When complete combustion obtained, the products were aqueous vapors, carbonic acid, small quantities of sulphurous acid and traces of nitrogen oxides, but the greater part of the nitrogen was unaffected. Careful search was made for hydrocyanic acid, but without success. The sulphurous acid was quickly converted into sulphuric acid. The products from the batswing and Argand burners contained no hydrocarbons or carbonic oxide, but the Welsbach yielded small quantities of imperfectly consumed carbonaceous bodies. It was observed that the degree of completeness of combustion was more dependent on the construction of the burner than upon the quality of the gas, from which the conclusion may be drawn that gas can be completely oxidized in a properly proportioned burner, and that the production of carbonic oxide or aldehyde can readily be avoided. One hundred volumes of the products of combustion contained 74 parts of water and 26 of carbonic acid, while the sulphurous acid did not amount to one volume in 2,500. This result was obtained from gas that had not been subjected to any special treatment for the reduction of the sulphur compounds, and fully illustrates the absurdity of claiming that these compounds can have any effect, one way or the other, upon health or upon anything else. Experiments were made by subjecting animals to the influence of the products of combustion, and also by collecting the condensed water and using it for subcutaneous and for intravenous injections, but no indication of poisonous matters could be found, from which it is evident that the products of combustion simply act as diluents of the oxygen in the air, and that no injury whatever can result from the use of coal gas with ordinary reasonable care and intelligence. It was observed that the animals were not distressed by the presence of as much as 3 per cent. of carbonic acid in the air, and that in badly ventilated rooms lighted by gas the quantity of carbonic acid did not reach 1 per cent. With proper ventilation, not more than 2 to 3 parts in 1,000 were present and the sulphur acids did not exceed four parts in 10 millions. In these days, when so much is made of the products of combustion, in respect to their capabilities for shortening life and injuring health, it is desirable that plain commonsense facts, such as those above instanced, should be more widely known amongst users of gas. The Christiania results are substantiated by the practical experience of 50 years. Although each one of our modern refinements appears to carry with it a particular class of disorders or diseases, the medical profession has not yet discovered that gas consumers are liable to any special ailment that could be got rid of by discontinuing the use of gas. The death rate is not affected in localities where gas is largely used. The experiments may also be cited against the prejudice, now rapidly dying out, that food cooked by gas must necessarily taste of gas, or be impregnated with some objectionable or poisonous substance. But they must not be strained to form an excuse for neglecting proper rules of ventilation, which are necessary under any circumstances, whether gas is used or not. The necessity for complete combustion and good ventilation cannot be too strongly urged.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

WE understand that a corporation, to be known as the Manistee Fuel and Gas Company, is in the projected stage. It is to bear a capital burden of $100,000, and it proposes to supply fuel gas in Manistee, Mich. There may be profit to the projectors in the development of this scheme; but the existing cold fact is that the present Manistee Gas Light and Coke Company finds it a rather difficult matter to sell enough gas to keep it in the procession.

THE Summit (N. J.) Gas Light Company is extending its main system through the borough of Millburn.

MR. JOSEPH R. TRISSLER, Chairman of the Lamp Committee, of Lancaster, Pa., invites proposals, to be opened at 7:30 P.M., of Wednesday, November 25th, for "furnishing light, lighting, extinguishing, caring for and keeping in repair, and for the furnishing of all the material necessary to keep in good order, and light the streets and public places of the city of Lancaster, and the lights furnished shall be of 2,000-candle

power for arc lamps; gas lamps to be furnished with 5-feet burners; and gasoline burners shall not be less than 16-candle power."

MR. M. N. DIALL, of Terre Haute, Ind., has invented a curling iron heater, gas being the heating agent, which has fairly "taken the hair," for every matron and maid in Terre Haute is using this acceptable addition to their list of toilet articles.

MR. H. H. KELLY, formerly connected with the Waltham (Mass.) Company has accepted the position of Superintendent to the Chelsea (Mass.) Company.

MR. C. O. MCCREEDY, who has secured control of the Ballston Spa (N. Y.) Gas Light Company, announces that on and after November 1st the gas rate there shall be $2.50 per 1,000 cubic feet, a concession of 50 cents per 1,000.

AT the annual meeting of the Conshohocken (Pa.) Gas Light Company the following officers were elected: Directors, Frederick Light, Richard H. Bate, John F. Bowker, Horace C. Jones and Henry M. Tracey; President, Frederick Light; Secretary and Treasurer, H. M. Tracey.

THE proprietors of the Doylestown (Pa.) Gas Company have notified the residents that on and after November 1st the price of gas will be $2 per 1,000 cubic feet, whether the gas is used for lighting, heating or power purposes, to those who use over 250 cubic feet per month, but less than 5,000 cubic feet. Where the consumption is 5,000 cubic feet or over, the rate is to be $1.75 per 1,000. If the consumption is less than 250 cubic feet per month the $2 rate, plus 25 cents for meter rent, is to obtain.

THE Leavenworth (Kansas) Light and Heating Company is overhauling its main system.

AT a recent meeting of the Committee on Light, of the City Council, of Richmond, Va., the Superintendent of the municipal gas works, Mr. W. P. Knowles, reported that the sendout for September was 14,490,900 cubic feet, as against 12,857,400 cubic feet for September, 1895. The illuminating power averaged 21.86 candles. A resolution forwarded by Colonel H. C. Jones was read. It called for the publication in the monthly reports of a statement respecting the "physical condition" of the gas plant, and also directed that an inspection of the plant be made by three expert gas engineers, who were to hand in the results of such inspection to Councils in the shape of a set report. After discussion, the resolution was laid on the table until the next meeting, for the purpose of inviting Col. Jones to make before the Committee a detailed explanation of the intent or purpose of the resolution. In the matter of the sale of coal tar, the contract for which for a certain time had been awarded to a Mr. Armitage by the Committee, but which action was subsequently rescinded and bids advertised for, Mr. Wallerstein presented a number of letters received from leading gas works in the country quoting the highest prices paid for tar. After due consideration the Committee decided to award the contract to Mr. Armitage at his bid of $1.90 per 100 lbs. in bulk. Leave of absence was granted to Supt. Knowles to enable him to attend the St. Louis meeting of the American Gas Light Association.

MESSRS. BARTLETT, HAYWARD & CO, of Baltimore, Md., have been awarded a contract for the erection of a 1,000,000 cubic foot capacity holder for the Lynn (Mass.) Gas and Electric Company. The holder, which is to rest in a steel tank, and to be of the triple lift order, is to be erected the coming summer.

THE annual election for officers in the Mansfield Gas Light Company and the Mansfield Electric Light and Power Company, of Mansfield, Ohio, resulted in the choice of the following: President, S. E. Bird; Vice-President, H. M. Weaver; Secretary and Superintendent, Wm. C. Hedges; Treasurer, Joseph S. Hedges.

MR. MARTIN DALTON, for many years Superintendent of the Manufacturers' Gas Company, of Fall River, Mass., handed in his resignation on the completion of the details concerned in the absorption of that Company by the Fall River Gas Works Company.

THE Berlin Iron Bridge Company, of East Berlin, Conn., notwithstanding the almost general depression in business, reports that its plant is fairly well employed. At no time during the year has it run on short hours, and is now employing 400 men, running 10 hours, 6 days a week. It has contracts on hand to keep its plant employed on full time for the next two months. No very large contracts are on the books at present, but orders for small jobs are many. Some of these are: For the L. D. Brown & Son Co., Middletown, Conn., fireproof power plant, and also a new dye house; steel framework for the Fire Department building, Worcester, Mass.; power station for the electrical equipment of the N. Y., N. H. & Hartford Railroad, Stamford, Conn.; machine shop for the Baush & Harris Machine Tool Company, Holyoke, Mass.; new building for the Woonsocket (R. I.) Electric Machine and Power Co.; new steel bridge for the town of Green, Me.; a second bridge for the Cabot Mfg. Co., Brunswick, Me.; and similar bridges at Auburn, Pembroke, Turner, Buckfield and Bridgeton, Me.; a new roof for Messrs. Randolph & Clowes' buildings, Waterbury, Conn.; a steel bridge for Somerset county, N.J., to be located at Finderne; and many other smaller contracts.

THE Berlin Iron Bridge Company has also secured, through its representative at Cuidad Lerdo, Mexico, the contract for an iron market house at Guadalajara. In further mention of this contract the Company says that if this market house were built anywhere in the United States, and paid for in our own money, the contract price would be $5,615. The Berlin Company is, however, to receive in payment for this building Mexican silver dollars, and, therefore, its contract price with the city of Guadalajara is $11,230.

AT a meeting of the New Bedford (Mass.) City Council, held some days ago, an order was introduced by Ald. Hunt, asking for an investigation into the feasibility of establishing a municipal lighting plant, either gas or electric, or both. After some discussion the order was accepted, and the Committee on Street Lighting was instructed to carry on the investigation. It was also agreed that the expenditure on account of the preliminary examination should not exceed $250.

APPLICATION has been made to the Board of Trustees of Benicia, Solano County, Cal., by the proprietors of the Solano Electric Light and Gas Company, for the right to manufacture and distribute gas and electricity in the city of Benicia for a period of 15 years.

IT is likely that the adjoining suburb of Potwin may be lighted by gas by the Topeka (Kansas) Company. In any event the residents of Potwin have petitioned the Company to extend its mains to and through their borough.

THE Bristol Compauy, of Waterbury, Conn., reports a good trade in its specialties of "recording instruments for pressure, temperature and electricity."

SOME time ago we reported the instituting of a suit for damages against the Grand Rapids (Mich.) Gas Light Company, by E. A. McAuley, a bartender of that city, complainant putting his case on very novel grounds. The proprietor of the saloon in which complainant worked notified the Gas Company that gas was escaping from the house pipes, and asked them to look it up. The Company promptly sent two men to the house, who eventually located the leak in a pipe close to the meter. Prior to their entering the cellar, McAuley informed them that a valuable bulldog owned by him was confined in a kennel or something else in the cellar, and requested them to take care that the dog did not make "escape." The workmen naturally were more concerned with the effort to locate the gas escape than in seeing to it that the dog did not "escape," and the net result was that McAuley's dog got away. His complaint alleged that it was through the negligence of defendant's servants that he was bereft of his canine, wherefore the Company should be held in damages for such neglect. The case came for trial some days ago, before Judge Grove and a jury, and after the testimony was all in the Judge took the case from the jury and ordered the taxation of costs against the plaintiff. The Judge held that the men were on the premises for the purpose of repairing gas pipes and not for the purpose of watching a dog, and added that if McAuley wanted to be sure of the continued presence of his dog he should have watched the animal himself.

"WESTERN OBSERVER," writing from Chicago under date of the 19th inst., says: "A few days ago I had the pleasure of meeting 'Uncle Jerry' Howard, in Galena, Ills., his home. He is the same 'Uncle Jerry,' and hopes to greet all of his Eastern friends in St. Louis next week.——Mr. George G. Ramsdell was in town last week, and will remain West until after the St. Louis meeting.——A movement is on foot, of which you doubtless know, to hold the next annual meeting of the Ohio Association in New York, during the progress of the gas exhibition. I hope this will be carried through, as it will give all the members a chance to attend the exhibition, and enable them to secure

cheap railroad fares. Then, again, as the Western Association meets in Cincinnati, in May, the bringing forward of the Ohio meeting will put a fairer interval of time between the two conventions.——Mr. Charles R. Faben, Jr., is completing an entirely new coal gas plant for the Toledo (Ohio) Company. The buildings in which his coal gas plant was housed were erected 30 years ago, and they were completely razed to permit of the construction of a modern building on the old site. He is also finishing two 24-ft. purifying boxes."

THE Cincinnati *Commercial-Tribune* of the 19th inst. had this to say: "The frequent accidents and fires where gasoline was kept on the premises have aroused the Rating Committee of the Fire Board to action. Notices have been sent out to the effect that hereafter a charge of 10 cents on buildings and 25 cents on contents will be made in addition to the regular rates on risks where gasoline machines are used, or where gasoline is kept in machines, or on the premises."

IT is said that a Philadelphia syndicate, headed by Mr. J. Taylor Leland, has applied to the Town Commissioners of Delaware City, Delaware, for a franchise for the operation of a gas and water works system for that place. Delaware City is on the Delaware river, at the junction of that stream with Delaware Bay. It is 12 miles southwest of Wilmington, and is the eastern terminus of the Chesapeake and Delaware Canal. It is also the terminus of the Pennsylvania and Delaware branch of the Pennsylvania Railroad.

THE City Council of Winnipeg, Manitoba, has under consideration a resolution introduced by Ald. Kennedy to provide for the issuance of $375,000 of bonds, the moneys so obtained to be used for the construction of a combined gas and electric lighting plant.

THE Citizens Gas Company, of Bridgeport, Conn., is said to be supplying gas for fuel purposes to about 300 consumers. The rates established by the Company are: Gross, 50 cents per 1,000 cubic feet, with 20 per cent. off for payment within 10 days; 30 per cent. off if monthly consumption exceeds 10,000 cubic feet; 40 per cent. off if monthly consumption exceeds 15,000 cubic feet; 50 per cent. off if monthly consumption exceeds 50,000 cubic feet.

MR. W. C. POND has been promoted from the Secretary-Treasurership of the Hyde Park Gas Company, of Chicago, to the responsible dual position of Vice-President and General Manager to that corporation.

MANY noteworthy improvements have been made on the plant of the Streator (Ills.) Gas and Light Company.

THE new holder for the Burlington (Ia.) Company has been accepted as in all respects complying with terms of the contract under which it was constructed.

MESSRS. GEORGE GATTS and B. Reynolds, in the role of itinerant meter testers, recently appeared before the Board of Public Works, of Kansas City, Mo., and asked for authority to test the gas meters in use in that city, the city to pay the Gatts-Reynolds combination 50 cents for each meter "tried." The Board referred the applicants to the Gas Committee of the lower branch of City Councils.

THE following is from a recent number of the Denver (Col.) *Times*: "It is quite safe to say that the improvements in the manufacture of illuminating gas have made as great progress as in that of any other industry. Electricity has become an active competitor, and is largely instrumental in spurring the Gas Companies to attain the highest degree of efficiency, coupled with lowness of cost. That gas is the cheapest, best and most reliable means of lighting has been established beyond a doubt. It is much more reliable than electricity, always ready for use, and, what is more to the point these hard times, is provided at a considerable less cost. The gas supply of Denver is one of the best to be found in the United States, as it has a high standard of illuminating power and is furnished at a price as low as any of our cities, taking into account the fact that the Company in Denver has to pay at least 40 per cent. more for its materials than Eastern Companies. The policy of the Company has been to study the interests of the consumer, realizing that by such a policy it would earn the goodwill of its patrons, making their interests mutual, thus preventing all that feeling of prejudice that exists in many cities against like undertakings. The works of the Company were established in 1868, and had then a capacity of 50,000 feet per day, the price of gas being $5 per 1,000 feet. Consider the contrast by to-day's capacity, which is 2,500,000 feet per day, and the price is $1.50 per 1,000 for illuminating gas and $1 per 1,000 for fuel gas, whereas in that early day the consumers numbered a few hundreds, now they number over 7,000. It is anticipated that this year the Company will sell at least 250,000,000 feet of gas. It has always been progressive, providing lighting facilities in every corner of the city and laying its mains, of which there are over 73⅛ miles, into every new district as it sprang into existence. The works are maintained in the highest state of repair, and everything conducive to efficiency and economy is employed. The management has been careful to provide for the future growth of Denver, for the works are capable of supplying a city having three times her present population. There is one department to which the Company has devoted considerable attention, and which is well worthy the careful consideration of every housekeeper, and that is the use of gas for cooking, and as a means of heating residences or large buildings. In this respect it has been very successful, for it has placed before its patrons gas stoves and heaters that are much more economical than coal, wood or oil, and which present so many other advantages to the housewife that any one using them will never be without them. Everyone should call at the office of the Gas Company and have these cooking stoves, ranges and heaters explained to them, for it will be money in their pockets, not to mention the immense saving of labor. The following gentlemen comprise the Board of Management: Hon. J. B. Grant, President; George Coppell, Esq., Vice-President; F. W. Herbert, Esq., Secretary, and A. H. Branch, Esq., General Manager and Treasurer. All of these gentlemen are noted for their rigid adherence to strictly honorable business methods. They are public spirited, and fully realize the responsibility that the Gas Company plays in the upbuilding of Denver, and are prepared at all times to have the Company do its share. We hope that our citizens will realize some of the difficulties that had to be overcome before the present satisfactory condition was reached. Thousands upon thousands of dollars have been sunk in improvements, which are to-day useless, but the management are resolved that the Company shall be no 'back number,' but constantly up-to-date and an undertaking of which our citizens may justly be proud."

Compound versus Triple Expansion Engines.

Engineering says that the annual reports made by Mr. Michael Longridge, M.I.C.E., to the Engine, Boiler and Employers' Liability Insurance Company, Limited, of Great Britain, always contain matter of interest. This year the question is raised as to whether, considering the present price of coal, triple expansion engines have sufficient advantages over well designed compound ones to justify the increased capital expenditure which they necessitate. In order to get an idea as to the steam consumption of well designed compound engines working at a high pressure, Mr. Longridge took the opportunity which presented itself of changing the cylinders of a McNaughted engine indicating some 200 indicated horse power so as to work with high pressure steam. The new cylinders were 17 in. and 36 in. in diameter respectively, and were completely jacketed, the liners being fitted with ribs so as to increase the absorption of heat. Care was taken to reduce the clearance spaces and surfaces to a minimum. On trial, being supplied with steam at a pressure of about 135 lb. per square inch above the atmosphere, the engines took in one case 12.82 lb. of steam per indicated horse power per hour, of which 1.53 lb. was accounted for by the jacket condensation. The speed was 34 revolutions per minute. The results attained are excellent, the best result recorded hitherto by a compound engine being that for a pumping engine of 643 horse power designed by Mr. Leavitt, which used 12.16 lb. per indicated horse power per hour, the steam pressure in this case being also about 134 lb. per square inch. It is interesting to note the increased economy which arises in a compound engine with an increase in the initial pressure. Thus, with pressure less than 90 lb. per square inch, the best reliable results on record are those of a Sulzer engine taking 13.35 lb. per indicated horse power per hour.

The best reliable results obtained with a triple-expansion engine are those of the Allis engine at Milwaukee, where the consumption, when indicating 574-horse power, was 11.68 pounds per indicated horse power per hour, the steam pressure being 120 pounds per square inch. Ordinary triple-expansion engines give, however, much less satisfactory results, the best showing in the case of the marine engines reported on by a committee of the Institution of Mechanical Engineers being 13.35 pounds per indicated horse power hour, the boiler pressure being 179.58 pounds per square inch. Of course it is perfectly well recognized that under equally favorable conditions the triple-expansion must beat the compound engine, but, as Mr. Longridge points out, it may not always prove true economy to secure the higher efficiency. Concerning the action of the jackets, the latter proved extremely efficient in the case quoted, the steam at the end of the stroke containing but 11 to 12 per cent. of moisture. This is attributed to the comparatively slow speed at which the engines ran, Mr. Longridge considering jackets of doubtful advantage in the case of high-speed engines.

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MONDAY, OCT. 26, 1896.

The Market for Gas Securities.

City gas shares have been in good demand and notably better figures are quoted for Consolidated, which came in this morning (Friday) at 147 to 149, and some trading was done in it. Standard common has been inquired for, although the proposed issue of treasury stock, to be offered to holders of record at a named price, has naturally had the effect of weakening values in it. The "subscribers' rights" to this allotment are 1¼ bid, to 1⅜ asked. Equitable and Mutual show no particular change. The matter of the applications for fuel gas charters for this city, now before the Board of Aldermen, will be made a special hearing by the Board at the meeting to-morrow.

Brooklyn Union gas is steady, and the Company's 5's are strong, at 105½ bid. The Consumers Gas Company, of Jersey City, will pay a semi-annual dividend of 2 per cent. on the 2d prox. Chicago gas opened to-day at 66¾ bid, and by noon had sold up to 68½. The Bay State mess is less savory than ever. Most investors hope that Mr. Buchanan will go on to the end with the measures he has instituted. Baltimore is unchanged, Lacledes are higher, and Bay State common is offered at 8⅛.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks,

35 WALL ST., NEW YORK CITY.

OCT. 26.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	147	149
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	192	197
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	219	224
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	33	35
Preferred	2,000,000	100	..	62
Bonds 1st 5's	3,500,000	1,000	100	101
" 1st Con. 5's	1,500,000	.	85	88
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	.	..
Standard	5,000,000	100	80½	82½
Preferred	5,000,000	100	106	108
Bonds, 1st Mortgage, 5's	1,500,000	1,000	107	111
Yonkers	299,650	50	180	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	87	90
" " Bonds (5's)	15 000,000	1,000	105½	..
Bay State	5,000,000	50	8	8⅛
" Income Bonds	2,000,000	1,000	27	30
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	70	..
2d " " "	3,000,000	1,000		57
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	66¾	66⅞
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	60	75
" Bonds	600,000	1,000	97	101
Cincinnati G. & C. Co.	7,000,000	100	197½	198
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	30
Bonds (6's)	150,000	1,000	..	
Consolidated, Baltimore	1,000,000	100	61¾	62⅛
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	78	83
" Bonds	2,000,000	..	82	87
Hartford	750,000	25	..	14
Indianapolis	2,000,000	..	120	130
" Bonds, 6's	2,650,000	..	99½	101½
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind	1,000,000	100	80	85
Bonds	1,000,000	1,000	84	87
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	25	25⅛
Preferred	2,500,000	100	78	80
Bonds	9,034,400	1,000	91¼	92
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	52	53¼
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.		25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	88	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10,000,000	100	92½	92¾
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	.	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	59	63
Bonds, 5's	3,556,000	.	88	91
Wilmington, Del.	500,000	50	180	182

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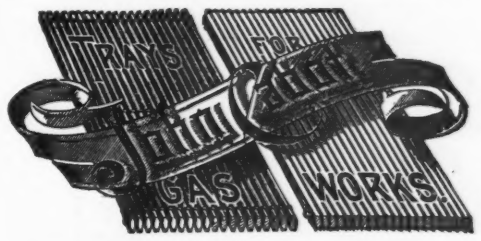

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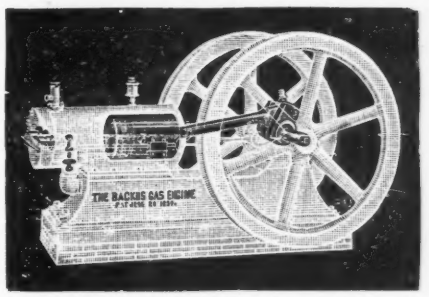

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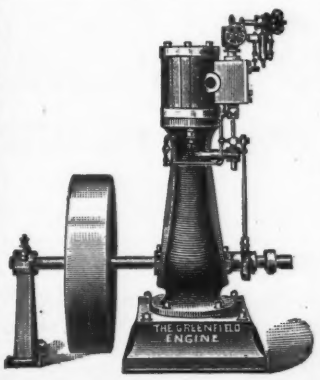

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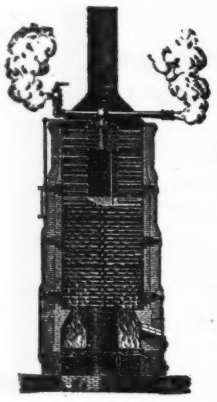

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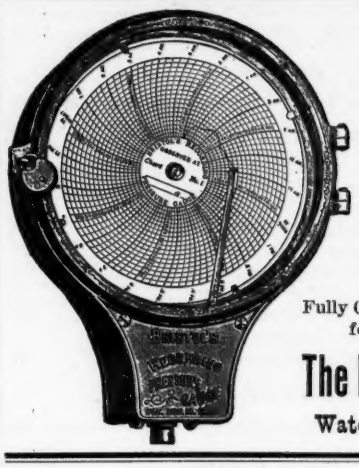

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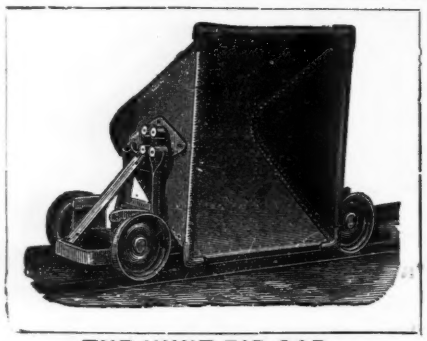

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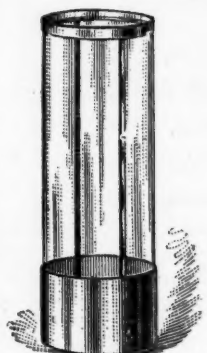

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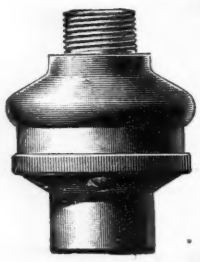

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PROSPECTUS.

THE object of the **Gas Exposition** is to bring together a collection of gas apparatus and appliances of every description, for the two-fold purpose of affording the general public and the gas engineer an opportunity to study the developments that have taken place in the gas industry during recent years. In submitting the plan of the Exposition to those who may feel an interest in the project, the management would call the attention of manufacturers of supplies of every description, entering into the manufacture of gas, to the great benefits which similar affairs have conferred on the industries of Great Britain, Germany and France, in which countries the exhibitions of gas appliances are held with recurring frequency. The creation of a healthy public sentiment in favor of gas is one of the first aims of large numbers of foreign gas companies.

MADISON SQUARE GARDEN.

In the selection of New York for the inauguration of an enterprise of this character, it is believed that no mistake has been made. In this city the Madison Square Garden is looked upon as one of the great show places of the metropolis; it contains within its walls the requisite space for the proper display of an almost unlimited amount of product, without which an affair of this kind cannot hope for the stamp of public approval—hence the selection of this great building for the inauguration of the gas industries exposition during the two weeks beginning January 25, 1897.

The greater New York contains a resident population of 3,000,000 people. Within a radius of 50 miles of Madison Square Garden live 4,500,000 people; reliable statistics show that an average of fully 100,000 strangers visit New York every day in the year. Thus it will be seen that the gas exposition will draw from a population of fully 6,000,000. In this connection it may be stated that every effort will be put forth that ingenuity can devise to thoroughly advertise the exposition, and create a desire in the minds of the public to come to the show; and once within its portals the dazzling brilliancy there abounding, coupled with the many attractive and instructive exhibits, will cause the visitor to wish to come again.

It is expected that cooking demonstrations will be a feature of the exposition. The lecture and concert hall, situated conveniently near the great amphitheater, in which the exposition is to take place, affords seating room for 1,200 to 1,400 people. The most experienced and talented ladies obtainable will be selected for this feature of the affair, which must prove one of the show's greatest attractions; not only for the housewives who may be attracted to it, but for gas managers, who will thus have an opportunity to study the advantages these gas cooking demonstrations offer as one of the means at hand for the education of people in the uses of gas.

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UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES.
} IN EQUITY.

The President of the United States,

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

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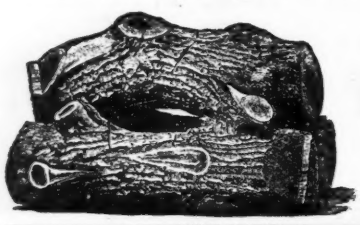

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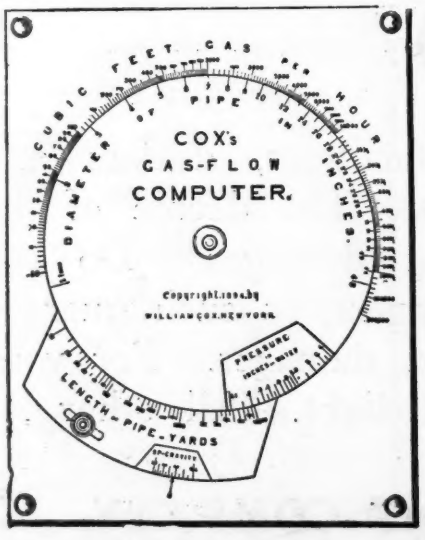

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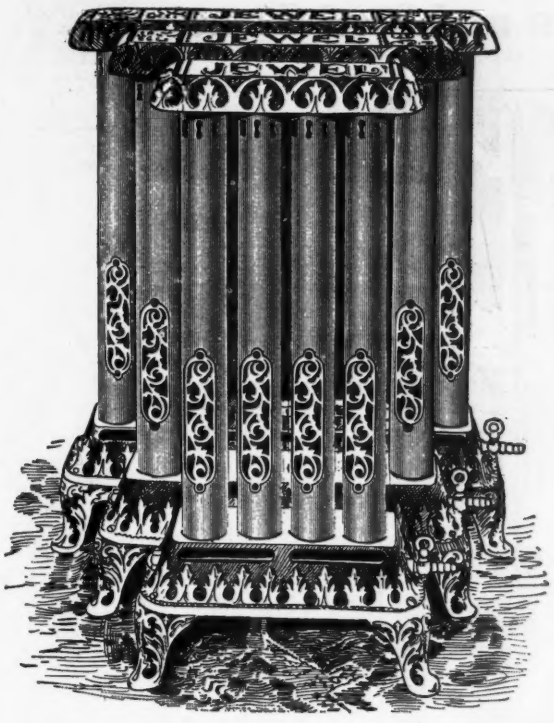

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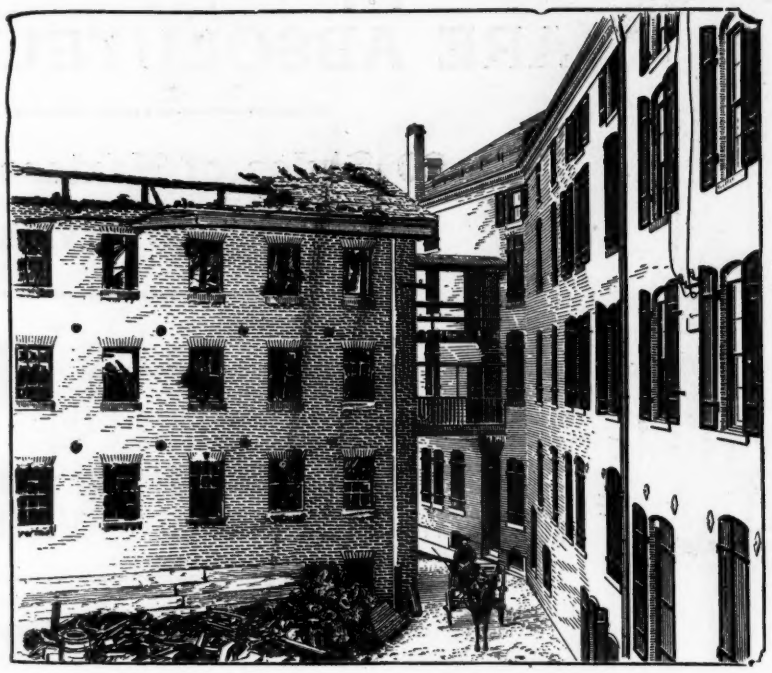

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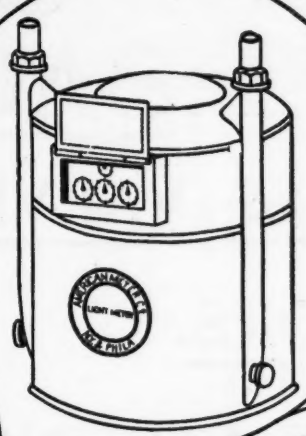

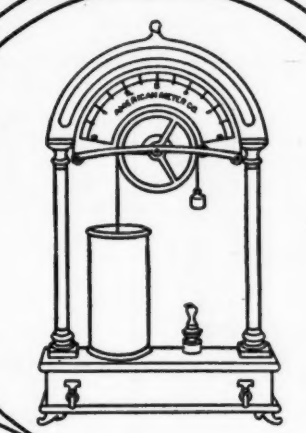

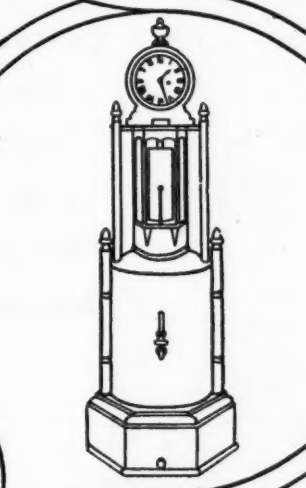

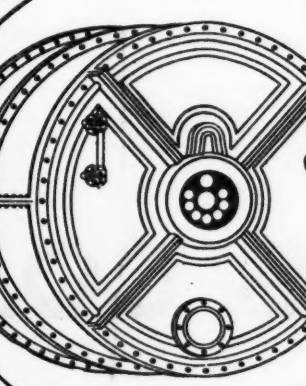

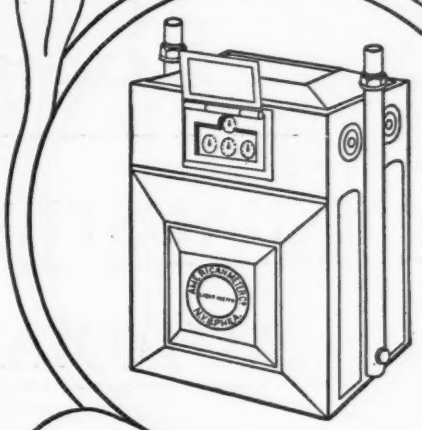

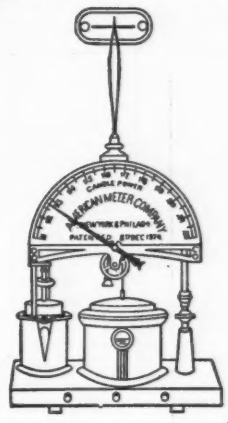

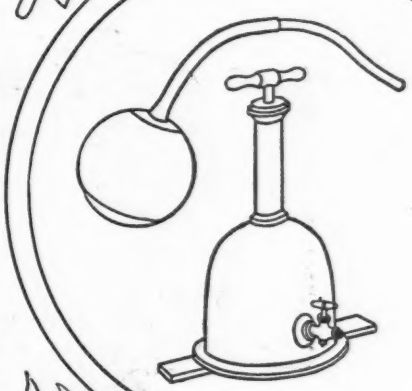

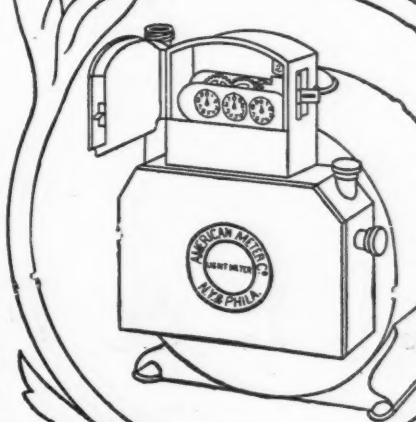

PUBLIC LIGHTING TABLE.

NOVEMBER, 1896.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	5.20 PM	5.30 AM	4.45	5.35
Mon.	2	5.20	5.30	4.45	5.35
Tue.	3	5.20	5.30	4.45	5.35
Wed.	4	5.20 NM	5.30	4.45	5.35
Thu.	5	5.20	5.30	4.40	5.45
Fri.	6	5.20	5.30	4.40	5.45
Sat.	7	5.20	5.30	4.40	5.45
Sun.	8	5.20	5.40	4.40	5.45
Mon.	9	7.50	5.40	4.40	5.45
Tue.	10	9.00	5.40	4.40	5.45
Wed.	11	10.10 FQ	5.40	4.40	5.45
Thu.	12	11.10	5.40	4.30	6.00
Fri.	13	12.10 AM	5.40	4.30	6.00
Sat.	14	1.10	5.40	4.30	6.00
Sun.	15	2.10	5.50	4.30	6.00
Mon.	16	3.10	5.50	4.30	6.00
Tue.	17	4.10	5.50	4.30	6.00
Wed.	18	No L.	No L	4.30	6.00
Thu.	19	No L. FM	No L.	4.25	6.00
Fri.	20	No L.	No L.	4.25	6.00
Sat.	21	5.10 PM	6.10 PM	4.25	6.00
Sun.	22	5.10	7.10	4.25	6.00
Mon.	23	5.10	8.10	4.25	6.00
Tue.	24	5.10	9.10	4.25	6.00
Wed.	25	5.10	10.20	4.25	6.00
Thu.	26	5.10	11.30	4.20	6.10
Fri.	27	5.10 LQ	12.40 AM	4.20	6.10
Sat.	28	5.10	1.50	4.20	6.10
Sun.	29	5.00	3.00	4.20	6.10
Mon.	30	5.00	4.20	4.20	6.10

TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00

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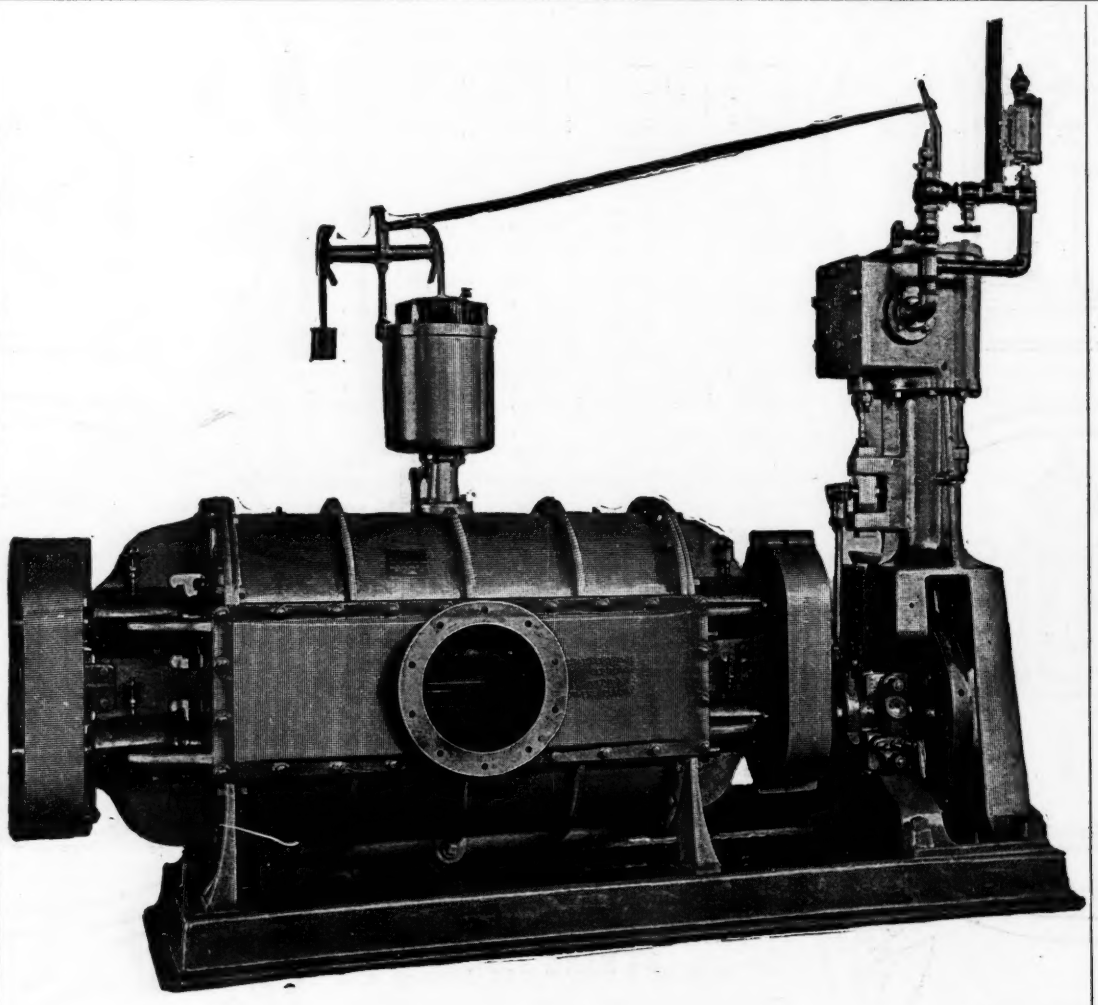

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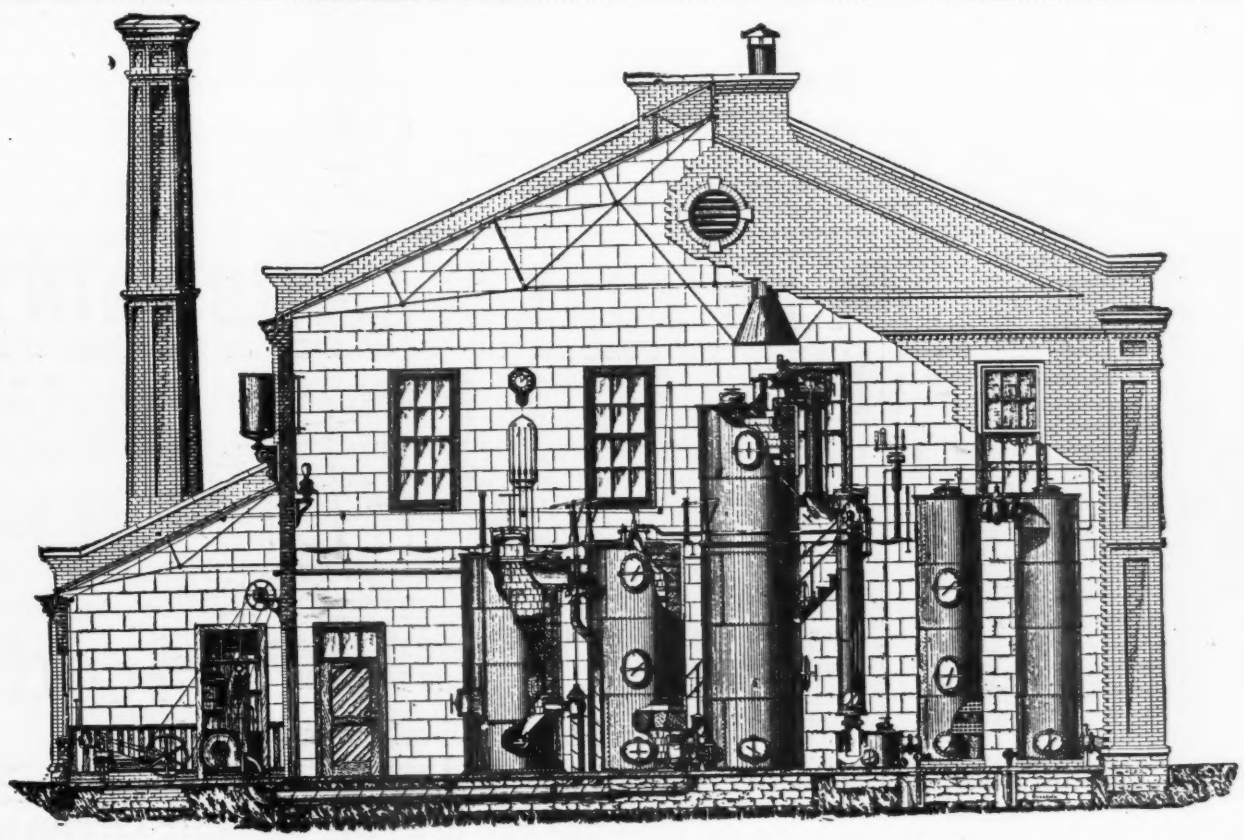

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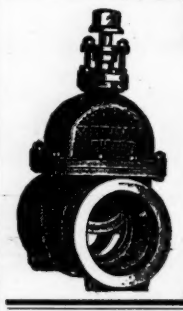

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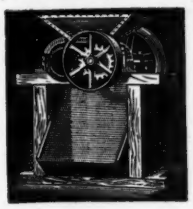

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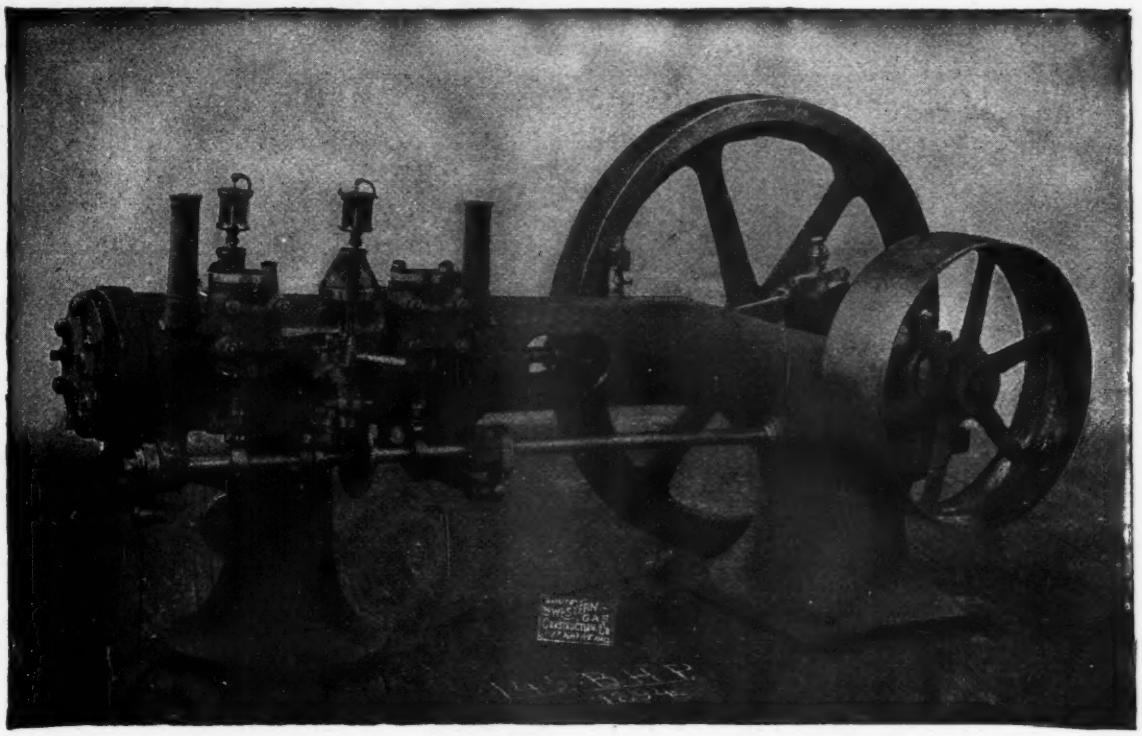

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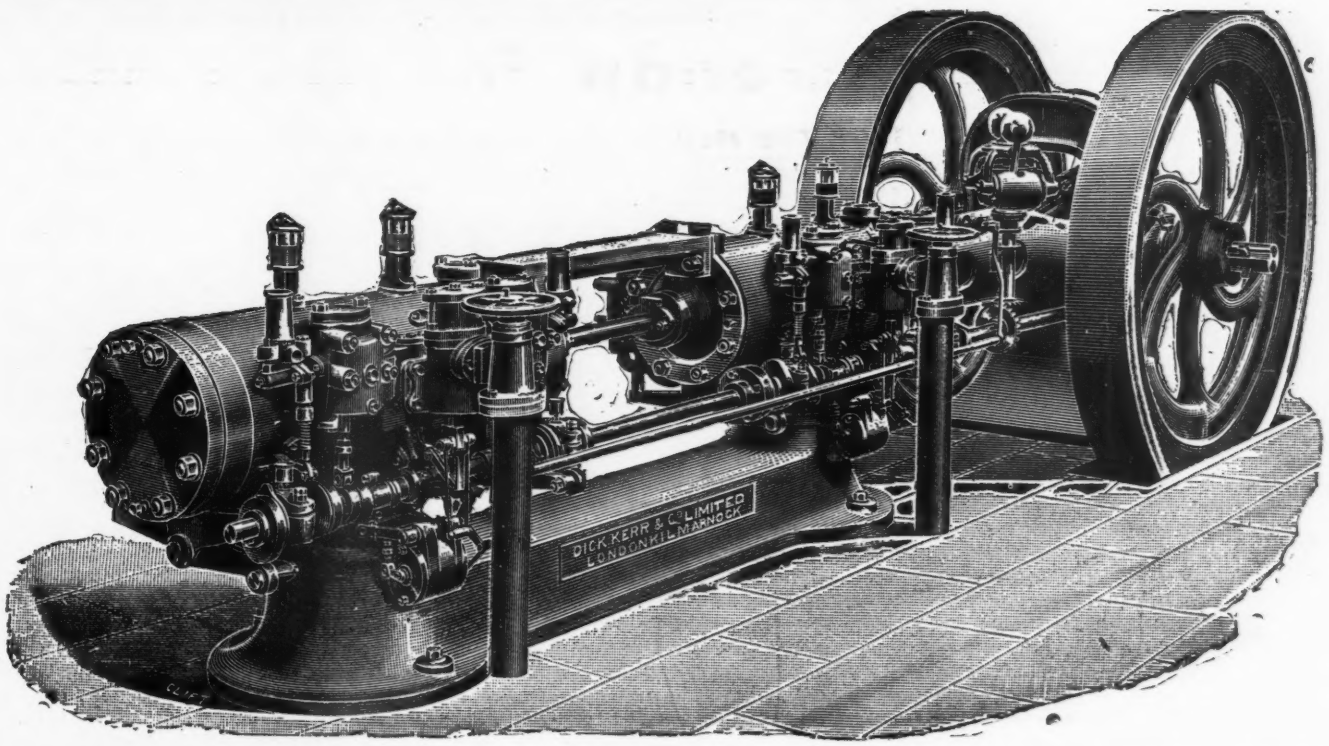

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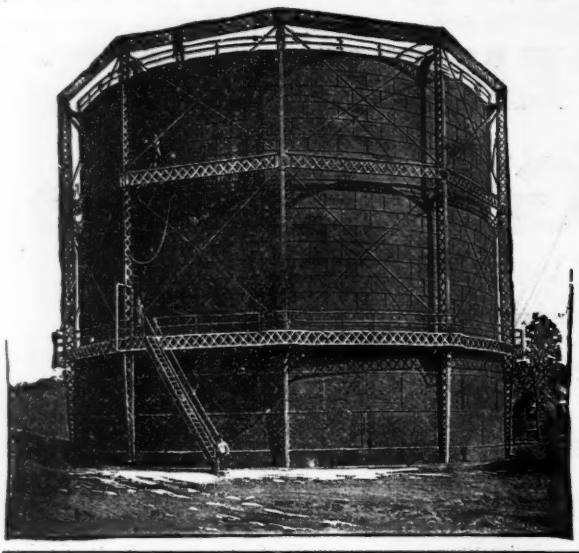

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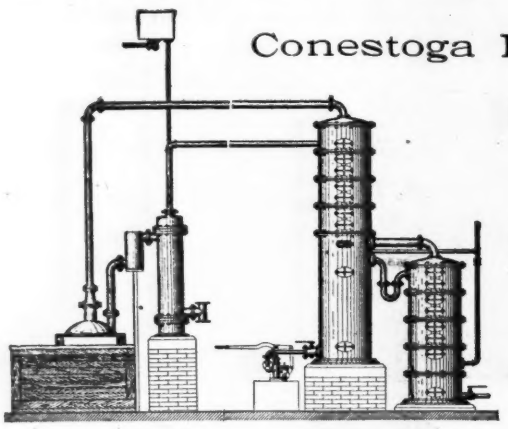

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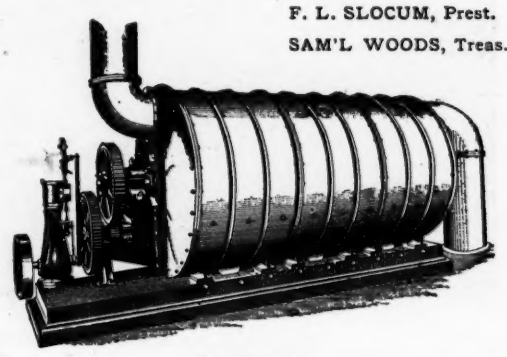

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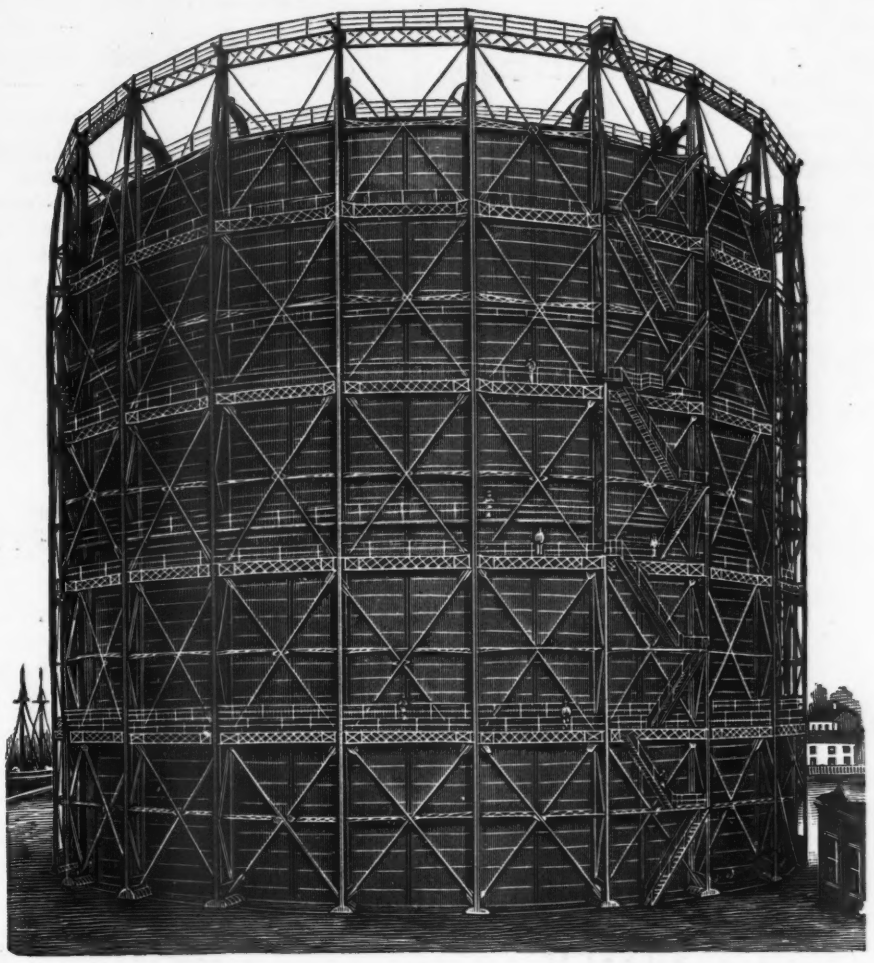

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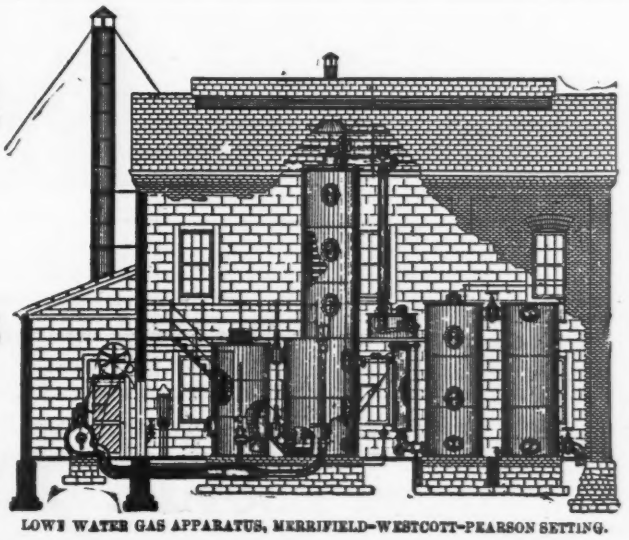

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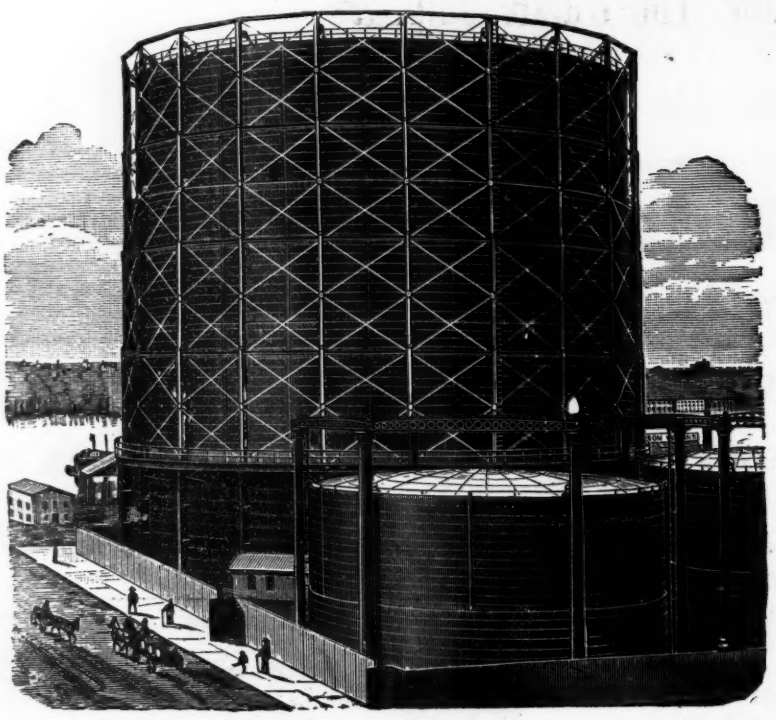

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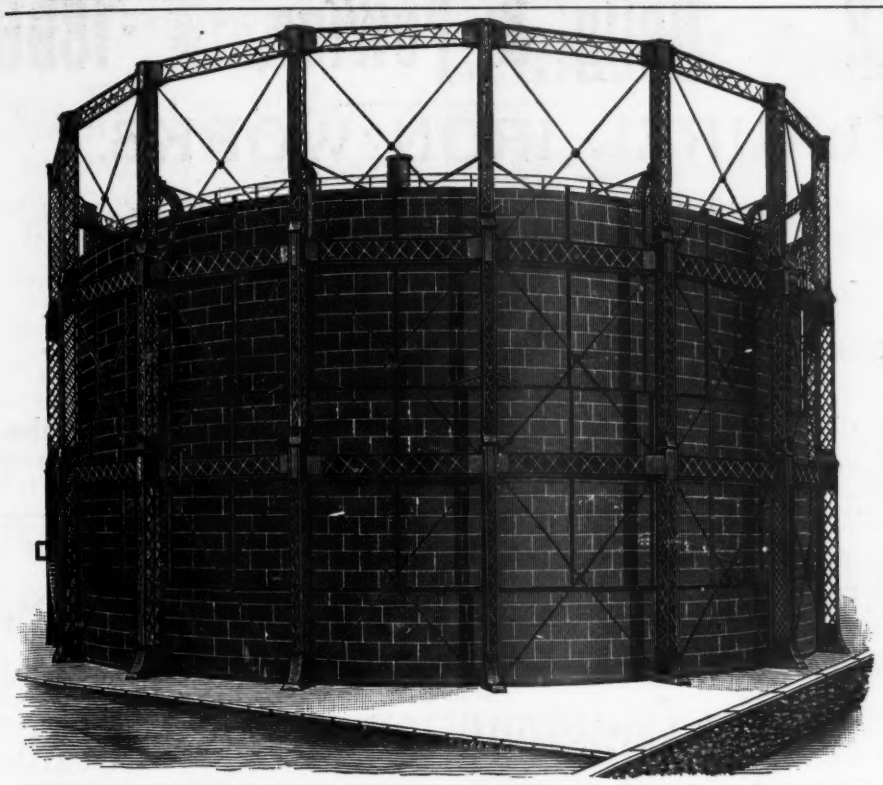

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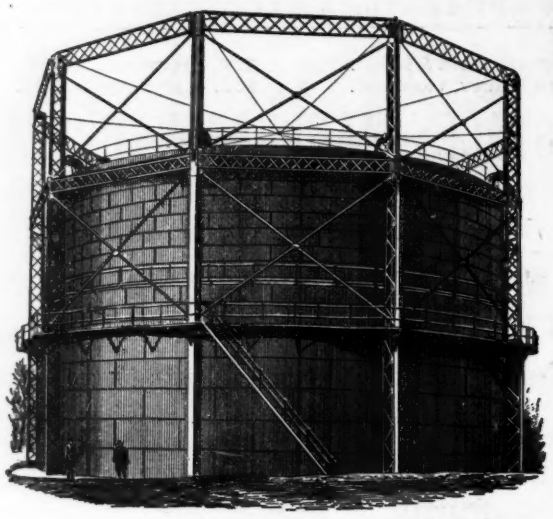

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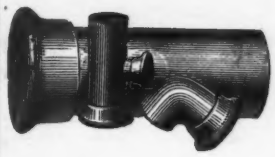

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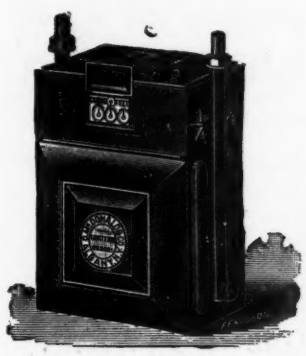

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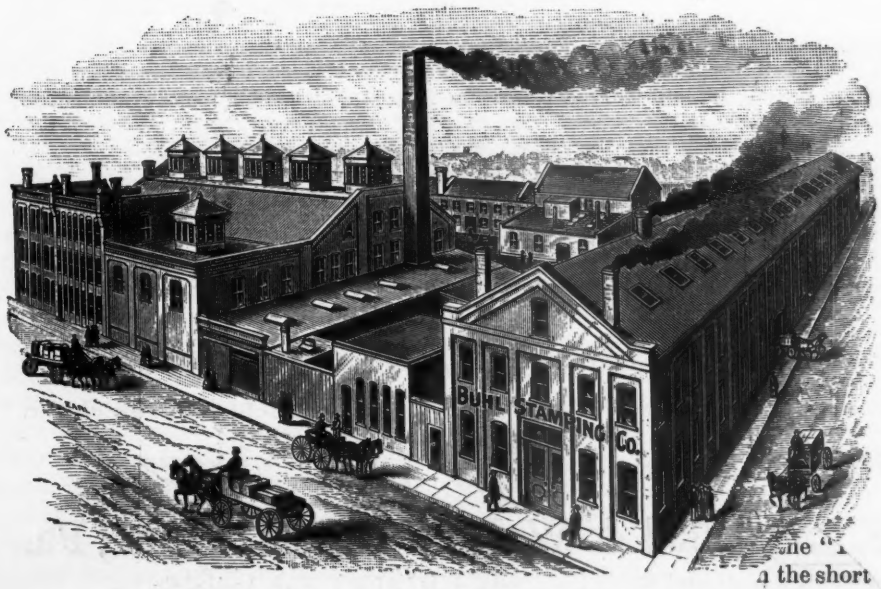

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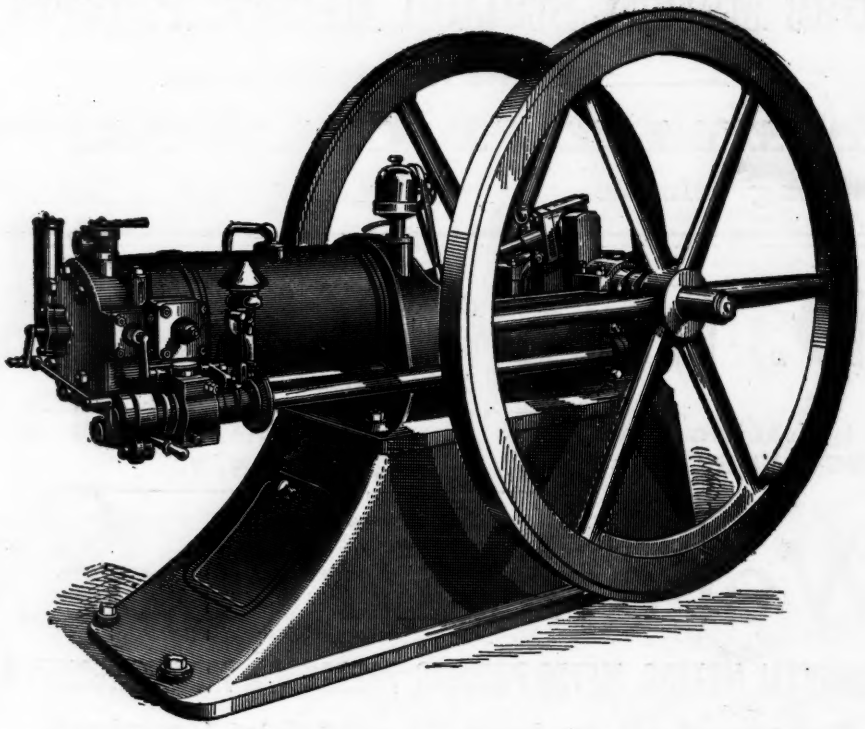

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